Geography

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The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
Obamaya apa sathya
Oba we apa shakthi
Apa hada thula bhakthi
Oba apa aloke
Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mana jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

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ஒரு தாய் மக்கள் நாமாவோம்
ஒன்றே நாம் வாழும் இல்லம்

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பொன்னும் மணியும் முத்துமல்ல - அதுவே
யான்று மழியாச் செல்வமன்றோ.

ஆனந்த சமரக்கோன்
கவிதையின் பெயர்ப்பு.



Being innovative, changing with right knowledge
Be a light to the country as well as to the world.

Message from the Hon. Minister of Education

The past two decades have been significant in the world history due to changes that took place in technology. The present students face a lot of new challenges along with the rapid development of Information Technology, communication and other related fields. The manner of career opportunities are liable to change specifically in the near future. In such an environment, with a new technological and intellectual society, thousands of innovative career opportunities would be created. To win those challenges, it is the responsibility of the Sri Lankan Government and myself, as the Minister of Education, to empower you all.

This book is a product of free education. Your aim must be to use this book properly and acquire the necessary knowledge out of it. The government in turn is able to provide free textbooks to you, as a result of the commitment and labour of your parents and elders.

Since we have understood that the education is crucial in deciding the future of a country, the government has taken steps to change curriculum to suit the rapid changes of the technological world. Hence, you have to dedicate yourselves to become productive citizens. I believe that the knowledge this book provides will suffice your aim.

It is your duty to give a proper value to the money spent by the government on your education. Also you should understand that education determines your future. Make sure that you reach the optimum social stratum through education.

I congratulate you to enjoy the benefits of free education and bloom as an honoured citizen who takes the name of Sri Lanka to the world.

Akila Viraj Kariyawasam
Minister of Education

Foreword

The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

The government in its realization of the concept of free education has offered you all the textbooks from grades 1-11. I would like to remind you that you should make the maximum use of these textbooks and protect them well. I sincerely hope that this textbook would assist you to obtain the expertise to become a virtuous citizen with a complete personality who would be a valuable asset to the country.

I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

W. M. Jayantha Wickramanayaka,
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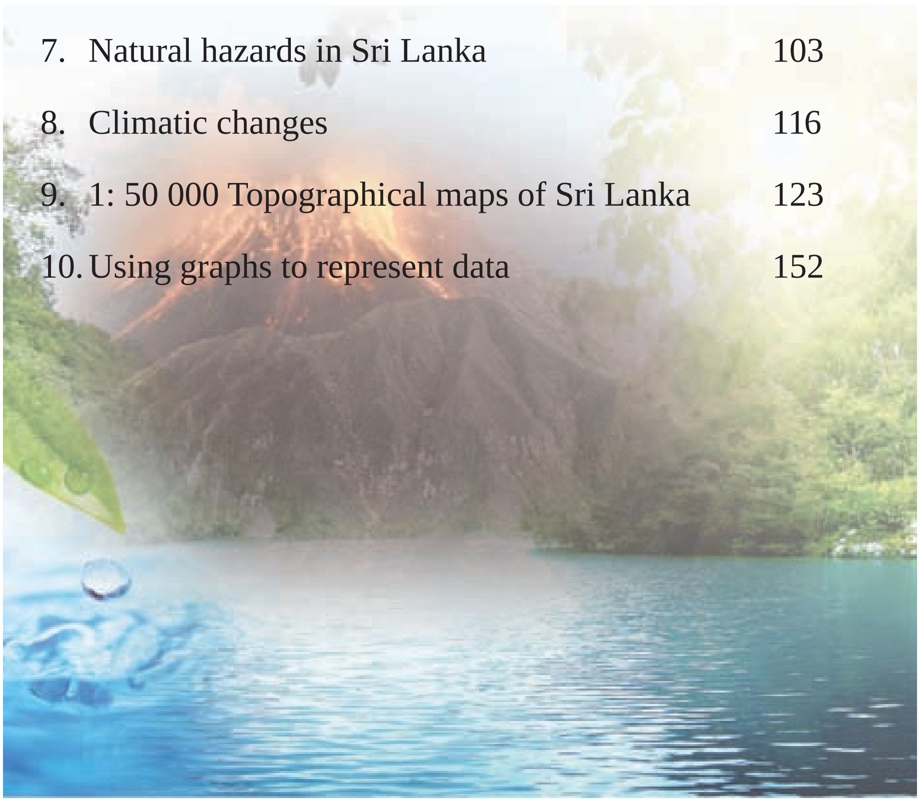
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Content



1 Natural Resources of the Earth

Things that are found in the natural environment which are required for the existence of man and his activities are called natural resources.

Rocks, minerals, soil, water, air, sunlight, vegetation and wildlife has a special place among the other natural resources. Man adds value to resources. Value of resources would be decided according to the needs of man and technology. The value of resources change from time to time.

The aim of this chapter is to study about natural resources on the Earth such as rocks, minerals, soil, water, air, sunlight, vegetation and wildlife.

Resources of the environment are diverse and they can be classified in many ways. (Fig. 1.1)

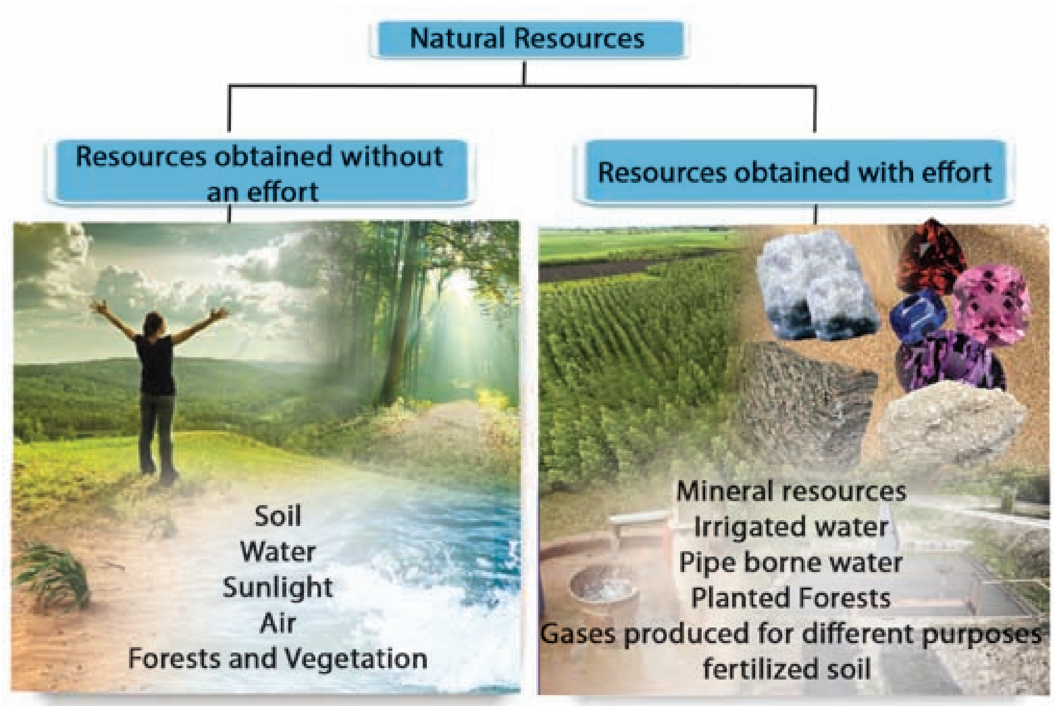


Fig. 1.1 - Classification of Resources

Natural resources can be categorized in the following manner as well.

Natural Resources

Exhaustible resources	Non - Exhaustible resources	Renewable resources
Fossil fuel	Water	Forests
Forests	Sunlight	Soil
Fertile soil	Air	Fish
Rocks		Wild life
Metal minerals (iron ore, copper, gold)		
Non Metal minerals (coal, Gems, Silica)		

Natural resources can be classified as Living and Non-living resources too.

Living Resources	→	Plant and animal resources in the biosphere.
(Biotic components)		(Forests, animal resources, aquatic resources).
Non-Living Resources	→	Water in the Hydrosphere, gases in the Atmosphere, minerals and soil in the Lithosphere, soil.
(Abiotic components)		(Water, soil, minerals, wind, tides).

Activities

01. Write a suitable definition for "Natural resources."

02. Explain by citing two examples to show how man converts environmental resources into valuable resources.

Rocks

Rocks have an important place among the other natural resources. The crust of the earth is composed of rocks. Rocks are formed by minerals. We can see some special features in the rocks formed by minerals. Some rocks are soft while some of them are hard. The rock layers are thin in some places while it is deeply spread in others. Hence, the values of the rocks differ according to the composition, distribution and their structure. Rocks can be classified into three types based on their origin.

1. Igneous rocks
2. Sedimentary rocks
3. Metamorphic rocks

Igneous Rocks

Igneous rocks are formed by magma coming from the interior of the Earth and solidifying on the crust. They are also called "Basic rocks." They are crystalline rocks formed by immense heat and pressure. There is a glassy and soft granular structure in them. Granite, basalt, gabbro are some examples for igneous rocks.

Intrusive igneous rocks are formed by cooling and solidifying magma in the interior of the Earth. Extrusive igneous rocks are formed by cooling of hot magma when reaching the surface of the Earth.



Fig. 1.2 - Igneous rocks (Granite)

Uses of igneous rocks

- Granite is used to construct buildings.
- Making ornaments.
- To obtain minerals such as tin and chromium.
- Igneous rocks, which are resistant to erosion, in slopes prevent soil erosion.
- To construct highways and roads.

There is an aesthetic value in the different physical formations of these rocks.

Sedimentary Rocks

Sedimentary rocks are formed by deposition and cementation of weathered particles of igneous and metamorphic rocks.

They are also called secondary rocks as they are formed by the sediments of principle rocks. Limestone, Coal and Gypsum can be cited as examples for types of sedimentary rocks.



Fig. 1.3 - Sedimentary Rocks (Gypsum)

Uses of sedimentary rocks

- Limestone and sandstone are used in constructing buildings.
- Alluvial sedimentary rocks are used for agricultural purposes.
- Used as a raw material in pottery industry.
- For production of ornamental goods.
- Coal is a source of energy.

Metamorphic Rocks

Metamorphic rocks are formed when Igneous and Sedimentary rocks are subjected to high pressure and high temperature.

Gneiss, marble, diamonds and dolomite are examples for metamorphic rocks. Metamorphic rocks can be seen more commonly than the other types of rocks.



Fig. 1.4 - Metamorphics Rocks (Graphite)

Uses of metamorphic rocks

- Diamonds are used to make jewellery.
- Marbles are used to create statues and ornaments.
- Graphite is used to make lubricants, casting moulds and paint.
- Dolomite is used for manufacturing fertilizer.

Areas where gneiss rocks were found were selected to construct ancient places of worship as those rocks were hard.

Activities

01. List the main types of rocks and give two examples for each of them.

02. Draw a poster to show the uses of different kinds of rocks.

Minerals

Minerals also have an important place among natural resources.

"A mineral is a naturally occurring substance that is solid and inorganic representable by a chemical formula and has an ordered atomic structure"

Source - *https:llenwikipedia.org/wiki/Mineral*

Earth is formed with rocks and rocks are formed with minerals. There is a strong relationship between minerals and rocks. Igneous, sedimentary and metamorphic rocks are made up of valuable minerals. The value of mineral resources depend on their uses.

There are about 2000 kinds of minerals in the world but people use only a few of them. Different kinds of minerals have been used for making weapons and tools during different periods of human civilization.

Mineral resources can be categorized as follows.

Fuel Minerals	Coal, Crude oil
Metallic minerals	Iron ore, Manganese, Copper
Non Metallic minerals	Graphite, Sand, Limestone and Phosphate

We discuss the most important resources such as iron ore, graphite and crude oil in this lesson.

Iron Ore - An important factor for the development of human civilization is the use of iron. Iron is extracted from iron ore. Iron ore is cleansed and smelted to extract iron. Through a chemical process, iron is turned into steel. Iron and steel have become very essential materials for industries like agriculture, construction and transportation because of their special qualities.

Main kinds of iron ore are Hematite, Magnetite and Limonite. An iron ore deposit would be economically valuable only if it contributes at least 30% of high quality iron. Map 1.1 shows the regions in the world with iron ore deposits.



Map 1.1 – Distribution of deposits of iron ore in the world

> **Activities**
>
> Iron and steel produced from iron ore are essential resources for industries like agriculture and transportation fields. Explain this statement giving examples.

Graphite

Graphite is an important mineral resource. Graphite industry became very important during the periods of world war. According to the classification of minerals, graphite come under non - metal minerals. Depending on the way it is embedded in the earth graphite can be further classified as follows.

- Vein graphite (As pure slabs)
- Crystalline flake graphite (As Flakes)
- Graphite spread in rocks

Main graphite producing countries of the world.

India	Turkey
Korea	Brazil
Mexico	Tanzania
Sri Lanka	Madagascar

India is the number one graphite producer in the world, producing 60% of world's graphite production. Sri Lanka also has gained an important place as a country that produces high quality graphite.

Graphite is an industrial raw material used in the electronic industry, construction of metal coverings, production of lubricants, pencils and paints. Graphite is also important as a heat and electric conductor.

Activities

1. Name the three types of graphite.
2. Explain the importance of graphite as a resource by giving examples.
3. Mark and name in a blank map of the world, the places where graphite is produced and, locations of the main iron ore deposits in the world.

Soil

Soil is formed by decomposition of organic materials for a long time and by mixing up remains of weathering rocks.

Soil is an essential resource for man. Survival of plants and animals depend on soil. It provides nutrition and water for the growth of plants. The soil layer is found as a thin layer on the surface of the earth. The thickness of the soil layer differs from one place to another.

Factors that contribute to the formation of soil

- Parent rock
- Topographical features
- Climate
- Time
- Parts of plants and animals
- Human Activities

Parent rock - Minerals are added to the soil by weathering of parent rock or deposition of sediments. The soil content, (composition) categories and the colour of the soil differ according to the nature of the parent rock.

Topographical features - According to topographical features, erosion of soil on earth's surface, deposition and infiltration of water into soil affect the formation of soil. Nature of soil and the drainage pattern are affected by the slope of an area.

Climate - Rainfall and temperature are climatic factors that affect the formation of soil. Interior temperature of the soil, the time period in which the moisture of soil present within a year, quantity of water that is retained in the soil are factors which affect the nature and formation of soil.

Plant and animal parts - Soil organisms and the cover of trees are sources that add organic particles into the soil. The cover of trees is the most important one. In areas where organic systems are abundant, a fertile humus soil layer would be formed within a short period of time.

Time - Time is an important factor in deciding the nature and the maturity of the soil. Fertility of soil increases when organic particles are deposited during a long period of time. Such soil which has a large quantity of mineral salts is suitable for the growth of plants.

Human Activities - Human activities are also a cause for variation of the nature of soil and growth of soil. Human activities can completely change the quality of soil and soil could also become infertile.

Soil has been used for agricultural purposes even from the time that man established permanent settlements.

Use of soil for human activities has increased along with the increasing needs of man. Instead of a variety of crops, cultivation of the same crop for a long time has caused decline in bio diversity and it eventually results infertile soil.

Since soil is essential for agriculture, more attention is paid for the conservation of soil.

Soil Profile

A soil profile is the set of layers of soil that is formed over a long period of time. Such a profile in seen in figure 1.5.

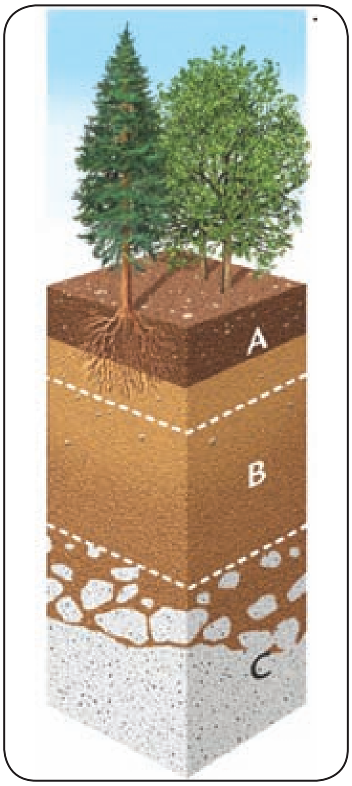


Fig. 1.5 - Soil Profile

Horizon A - It consists of decayed particles and partially decayed parts of animals and plants. The parent rock had completely weathered and a large quantity of organic particles are present. It is darker than the other horizons below. This soil is called Humus.

Horizon B - Mineral salts and clay particles leach to the Horizon A and some types of clay are deposited in this layer of soil. Horizon B is relatively lighter in shade than Horizon A.

Quantity of organic matter is low in thais horizon.

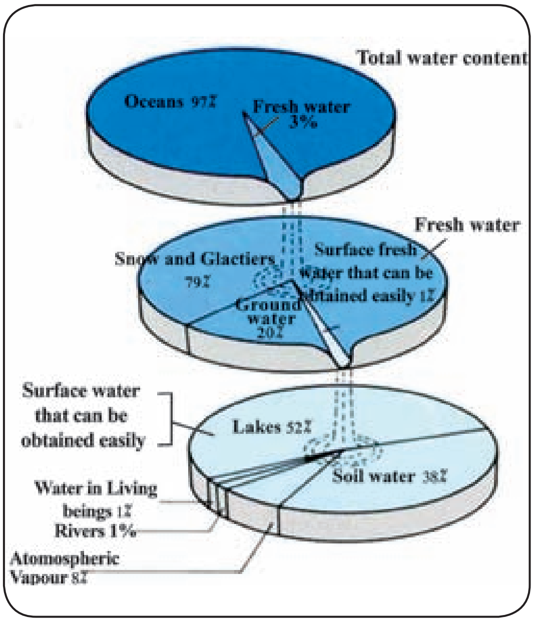
Horizon C - This Horizon consists of parent rock particles and remains or particles which are brought from other substances.

Activities

01. List the factors that contribute to the formation of soil and briefly explain three of them.
02. Draw the Horizons of soil and write the features of each.
03. Explain how soil helps the survival of plants and animals.
04. List three steps which can be taken to conserve soil.

Water Resources

Water is an essential resource for the survival of man and other natural ecological systems. Man cannot live without water except for a few days. Water is a resource which contributes to human activities directly or indirectly.



The Earth is called the 'Blue Planet' because it is the only planet which has water. The Earth consists of 71.8% of water while the land area is 28.2%. This water is stored in the Oceans, seas, rivers, reservoirs, tanks and ponds. 97% of water is sea water while 03% is fresh water. Man can easily use only 01% of the water which is a small quantity. Fig. 1.3 show how water resources are distributed Fig. 1.4 shows places where water gets stored due to the water cycle as well.

Fig. 1.6 Distribution of water resources.hppt//autoflownewolt.blogspoh

Source : *http://artoflonewolf.blogspot.-2015/06/17*

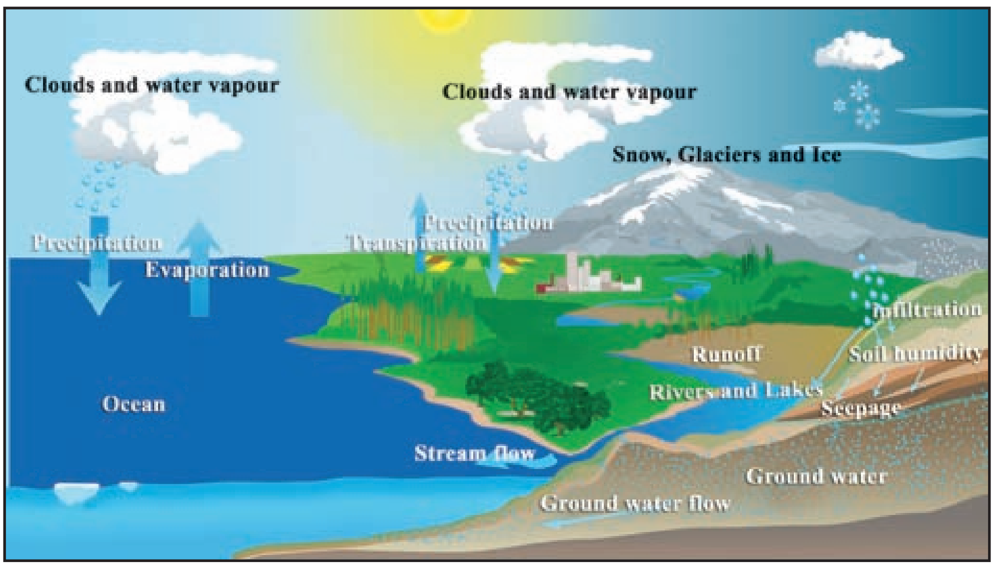


Fig. 1.7 - Water cycle

Source: *http://svs.gsfc.nasa.gov/2015/06/16*

Atmospheric water	Water is added to the environment due to evaporation and transpiration from plants and animals
Oceanic water	Water stored in oceans and seas
Surface water	Water stored in rivers, canals, snow
Soil water	Water absorbed by the soil
Ground water	Water from rain and irrigations which infiltrates into the earth and deposits on impervious rocks. (This water is used through wells and springs)

Sources of water

- Oceans
- Rain
- Internal reservoirs
- Ponds
- Ground water aquifers
- Glaciers
- Springs

Importance of water as a resource

Water is essential to man for of day to day activities, agriculture, industries and transportation. Man needs about three litters of water per day. If it could not be provided, he would be dehydrated.

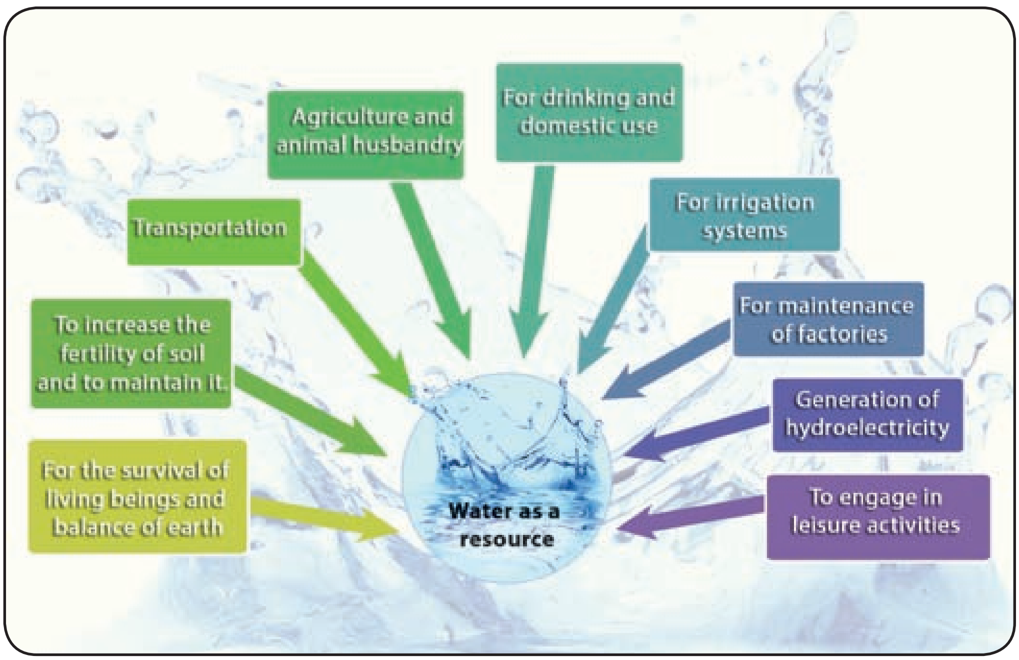


Fig. 1.8 - Importance of water as a resource

Water pollution occurs since waste water is added to rivers and streams. This contaminated water is not in a condition to be consumed by man, animals and the bio system. Thus water had become a scarce resource. It is assumed that this condition may lead to conflicts among people and nations to obtain water in the future.

Activities

1. Name three source from which man can obtain water.
2. Explain in brief, the terms, groundwater, surface water and soil water.
3. 'Water is essential for the survival of living beings'' state 3 facts to prove this statement.
4. Suggest three activities that can be done to conserve the water resource.

Forests

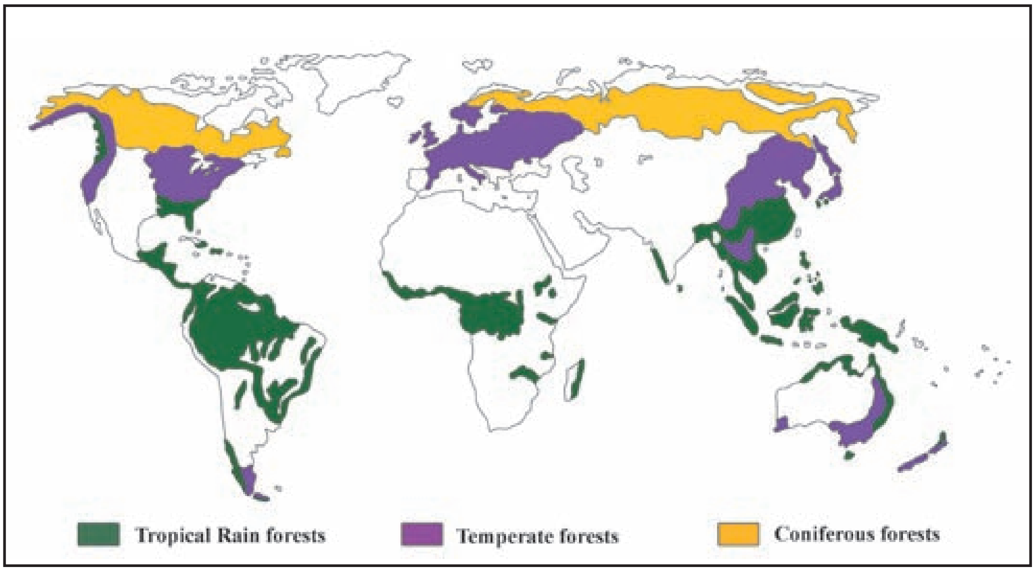
Forest is a very important eco – system.

A Forest is a land eco- system consisting of trees, climbers and plants useful to man and animals.

Forest have been used for many purposes since past. They are naturally grown or cultivated.

Forests vary from country to country, and from area to area according to the nature of climate and soil. There are different kinds of forests in the world, but we consider only there main types of forests.

- Tropical rain forests
- Temperate forests
- Coniferous forests



Map 1.2 - Distribution of forests in the world

Tropical Rain Forests		
Distribution	**Special Features**	**Wildlife**
• Region between tropic of Cancer and Capricorn • Estuary of the River Amazon • Central America • The Congo basin • Asian Region	• High bio-diversity • Speedy growth of plants • Several Layers of trees in the forest • Trees have many broad leaves • There are creepers and undergrowth Epiphytes are abundant. • Treeslike Mahogany, Ebony, Bamboo, Sandal wood, Acasia, Palms and Eucalyptus can be seen.	• Chimpanzee • Tiger • Gorilla • Mouse deer • Bear • Varieties of Apes • Serpents • Lizards • Reptiles • Varieties of fish

Temperate Forests		
Distribution	**Special Features**	**Wildlife**
• Latitudinal extent of these forests are between 30° - 50° North and South. • These forests are distributed in West and Central Europe, Eastern Coast of North America, Australia, Argentina South America and South China.	• There are evergreen and deciduous trees • Less bio - diversity • Hard heart wooded trees and broad leaves • No clear layers • Leaves fall during winter • Trees that provide economically valuable timber like Oak, Chest nut, Pine, Eucalyptus Douglas Fir, Beech, Ash and Lime	• Bear • Wolf • Siberian Tiger • Stag • Varieties of birds • Varieties of reptiles • Deer

Coniferous Forests		
Distribution	**Special Features**	**Wildlife**
• These forests can be found in areas between 50°–60° latitudes in the Northern hemisphere. • Western coast of America to Eastern coast of North America. • North Europe and North of Asia.	• Most of the trees are conical in shape. • Trees are well adapted to cold and dry conditions. • Leaves are needle shaped. • Oak, Maple, Beech, Spruce, Fir, Larch, Cedar, Poplar are trees found here. • Erect trunks and soft timber	• Rein deer • Panda • Polar bear • Stag • Lynxes • Mink • Varieties of foxes • Seals • Varieties of birds

Significance of these forests

- Protection of bio-diversity.
- Protection of wild life and ensure their survival.
- They are important as catchment areas and protects the underground water.
- Provides food, medicine, timber and fuel for living beings.
- Maintaining a clean atmosphere and help to maintain environmental balance.
- Gives natural beauty.
- Affects climatic conditions.
- Reduces soil erosion and protects fertility of soil.

Problems faced by Forests and living beings

- Clearance of Forests due to needs of increasing population.
- Destruction of plants and animals due to environmental pollution.
- Collecting plants and animals for commercial purposes put them in danger of extinction.
- Breeding of invasive species of plants and animals.
- Forests are destroyed because of natural disasters and human activities (bushfires, droughts, landslides, storms, setting fire to forests.)
- Construction of roads and development projects are also causes for forest destruction.
- Many species of flora and fauna are threatened with extinction due to climatic changes.

Activities

01. Mark the following places in a world map.
    Amazon Forest, Congo Forest, Madagascar Islands, Deciduous Forest areas of Europe, Coniferous Forests of North Asia.
02. Describe two reasons for destruction of Tropical Rain Forests.
03. Explain two problems faced by forests and wildlife.

Assessment

1. Using relevant pictures and statements do a classification of resources .
2. Find information regarding the resource in your environment and include them in these categories.
3. List mottos about value of resources and conservation. Display them in your school premises.
4. Prepare a article for the wall paper on the topic ‘Forests are our life’.

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- http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=30580

Glossary

- Rocks - පාෂාණ - பாறைகள்
- Minerals - ඛනිජ - கனியங்கள்
- Soil - පස - மண்
- Vegetation - වෘක්ෂලතා - தாவரப் போர்வை
- Exhaustible resources - ක්ෂය වන සම්පත් - அழிவுறும் வளங்கள்
- Non – exhaustible resources - ක්ෂය නොවන සම්පත් - அழிவடையாத வளங்கள்

- Fossil fuel - පොසිල ඉන්ධන - உயிர்ச் சுவட்டு எரிபொருள்
- Metal minerals - ලෝහමය ඛනිජ - உலோகக் கனியங்கள்
- Non metal mineral - අලෝහමය ඛනිජ - உலோகமல்லாத கனியங்கள்
- Renewable resources - පුනර්ජනනීය සම්පත් - மீளுருவாக்க வளங்கள்
- Living resources - ජීවී සම්පත් - உயிருள்ள வளங்கள்
- Non Living resources - අජීවී සම්පත් - உயிரற்ற வளங்கள்
- Tides - උදම් - வற்றுப் பெருக்குகள்
- Earth's crust - පෘථිවි පෘෂ්ඨය - புவி மேற்பரப்பு
- Rock composition - පාෂාණ සංයුතිය - பாறைச் சேர்க்கை
- Igneous Rocks - ආග්නේය පාෂාණ - தீப்பாறைகள்
- Sedimentary rocks - අවසාදිත පාෂාණ - அடையல் பாறைகள்
- Metamorphic rocks - විපරිත පාෂාණ - உருமாறிய பாறைகள்
- Crystalline rocks - ස්ඵටිකරූපී පාෂාණ - பளிங்குப் பாறைகள்
- Magma - මැග්මා - மக்மா
- Heat - තාපය - வெப்பம்
- Pressure - පීඩනය - அமுக்கம்
- Condensation - ඝනීභවනය - ஒடுங்கல்
- Sediments - අවසාදිත - அடையல்கள்
- Alluvial - දියළු - வண்டல்
- Pottery industry - කුඹල් කර්මාන්තය - மட்பாண்டக் கைத்தொழில்
- Marble - කිරිගරුඬ - சலவைக் கல்
- Diamonds - දියමන්ති - வைரம்
- Statues - ප්‍රතිමා - சிலை
- Lubricants - ලිහිසි ද්‍රව්‍ය - மசகு எண்ணெய்
- Casting moulds - වාත්තු අච්චු - உருக்கி வார்த்தல்
- Organic matter - ඓන්ද්‍රීය ද්‍රව්‍ය - சேதனப் பொருள்

Inorganic matter	- අකාබනික ද්‍රව්‍ය	- அசேதனப் பொருள்
Iron ore	- යපස්	- இரும்புத் தாது
Electronic conductors	- විද්‍යුත් සන්නායක	- இலத்திரனியல் கடத்தி
Decomposed matter	- ජීර්ණාවශේෂ	- உருக்குலைந்த பொருள்
Parent rock	- මව්පාෂාණය	- தாய்ப் பாறை
Deposition	- නිධිසාදනය	- படிதல்
Soil colour	- පසේ වර්ණය	- மண் நிறம்
Erosion	- ඛාදනය	- தின்னல்/ அரிப்பு
Infiltration	- කාන්දුවීම	- ஊடுவடிதல்
Drainage	- ජලවහනය	- வடிகாலமைப்பு
Moisture	- තෙතමනය	- ஈரப்பதன்
Humus	- හියුමස්	- உக்கல்
Maturity	- පරිණතභාවය	- முதுமை
Conservation	- සංරක්ෂණය	- பேணிப் பாதுகாத்தல்
Soil Profile	- පාංශු පැතිකඩ	- மண்பக்கப் பார்வை
Ground aquifer	- භූගත ජලධරය	- தரைக்கீழ் நீரேந்தி
Biological system	- ජෛව පද්ධති	- உயிரியல் தொகுதி
Water cycle	- ජලචක්‍රය	- நீர் வட்டடம்
Evaporation	- වාෂ්පීකරණය	- ஆவியாக்கம்
Transpiration	- උත්ස්වේදනය	- ஆவியுயிர்ப்பு
Springs	- උල්පත්	- நீரூற்று
Environmental balance	- පාරිසරික තුල්‍යතාව	- பௌதிகச் சமநிலை
Ecological system	- පරිසර පද්ධතිය	- உயிர் சூழல் தொகுதி
Tropical rain forest	- නිවර්තන වර්ෂා වනාන්තර	- அயன மழைக்காடு
Temperate forests	- සෞම්‍ය කලාපීය වනාන්තර	- இடைவெப்பக் காடுகள்
Coniferous forests	- කේතුධර වනාන්තර	- ஊசியிலைக் காடுகள்

- Biodiversity - ජෛව විවිධත්වය - உயிரினப் பல்வகைமை
- Undergrowth - යටිරෝපණය - கீழ் நிலவளரி
- Evergreen - සදාහරිත - என்றும் பசுமையான
- Deciduous - පතනශීල - இலையுதிர்
- Catchment areas - ජල පෝෂක ප්‍රදේශ - நீரேந்து பகுதிகள்
- Ground water store - භූගත ජල ගබඩාව - தரைக் கீழ் நீர்சேமிப்பு
- Bushfire - ළැව්ගිනි - காட்டுத் தீ
- Motto - ආදර්ශ පාඨ - வாசகம்
- Wall paper - බිත්ති පුවත්පත - சுவர் தாள்

2 Natural Resources of Sri Lanka

Sri Lanka is rich with natural resources. Ocean, land, rock, soil, minerals, water and forests are important resources among them.

The aim of this chapter is to study about utilization and conservation of natural resources of Sri Lanka.

Ocean

The exact land area of Sri Lanka includes not only the land but a part of the ocean too. An International Law was implemented on the 16th of November 1994 which helps to decide the ownership of maritime boundary in a country. According to that each coastal state owns a maritime boundary less than twelve nautical miles from the coast. It is called '**The territorial maritime boundary**'.

The air, sea and all internal resources of that boundary belong to Sri Lanka. This area which has islands , lagoons, head lands, bays, coral reefs, sand and rocks is very useful for the fishing industry and the tourism industry.

The zone between 12 -24 Nautical miles is called the '**Contiguous Zone'**. The government has the right to punish and take actions against the violation of laws in customs , fishing , migrations and sanitary laws within this zone.

The Zone between 24 – 200 Nautical miles is called the **'Exclusive Economic Zone'**. Living and non living natural resources, the sea bed and water particles of that area belong to Sri Lanka.

Other than the above maritime boundaries, Mannar strait, Palk strait, Bay of Bengal which belong to Historic waters (Internal waters) are divided between Sri Lanka and India by an agreement. All activities in this zone are taken place with the agreement of both parties.



Fig. 2.1 Territorial maritime boundary

Activities

01. Name the main natural resources of Sri Lanka.

02. Explain the term, 'Territorial maritime boundary.'

03. 'The ocean around Sri Lanka is a valuable natural resource'. Explain with examples.

Land

'Land' is also a very significant natural resource of Sri Lanka. The land area of Sri Lanka is 65610 km2 including the islands around it. The land is utilized

according to the variation of physical features such as Topography climate, natural vegetation and water resources. Settlements, home gardens, roads, agricultural crop lands, forests, shrub land and internal reservoirs are such examples.

Study figure 2.2 and identify how the land of Sri Lanka is utilized in different ways.



Fig. 2.2- Different ways the land is used

There are several main zones in Sri Lanka with a significant variation of the physical features of the land and the specific features pertaining to these areas could also be identified. Massive paddy fields and the irrigation systems in the dry zone, tea estates and the terraced paddy cultivation in the central hills, massive buildings with many storeys and the road systems in the urban lands , fishing industry in the coastal areas are examples for those specific features.

Problems related to utilization of land in Sri Lanka and methods of conservation of land

Problem	Methods of conservation of land
• Biological resources are destructed because of deforestation and clearing of slopes. • Flooding due to filling of low lands and obstruction of drainage systems. • Filling of reservoirs. • Destruction of coastal eco system . • Environmental , health and sanitary problems in the urban areas.	• Planning of land utilization policies. • Planning the towns and cities in a methodical way. • Cultivating environmental friendly crops. • Use new protective cultivation methods such as 'SALT'. • Replanting forests. • Creating coastal boundaries and implementing laws related to them. • Banning removal of corals. • Carrying out public awareness programmes.

Activities

01. Explain briefly how land in Sri Lanka is utilized in different ways.

02. Explain the significance of land as a resource.

Rocks

Land of Sri Lanka consists of Igneous, Sedimentary and Metamorphic rocks. These rocks are used for many purposes since past. When granite metamorphoses, it turns into gneiss. They are used in construction of buildings and roads. Hard gneiss was used for construction of stair ways, guard stones and pillars in religious buildings of Anuradhapura, Mihintale etc. Hard gneiss was also used in sculpting Samadhi and Aukana Buddha statue.

Miocene limestone is a sedimentary rock spread along the Jaffna Peninsula and the Northwestern coast. It is used for production of cement, to smelt iron ore and to construct buildings. Corals of the South Western coast are used for

producing lime. Dolomite, a metamorphic rock in Matale, Kandy, Balangoda, Nalanda, Digana and Habarana is used as a fertilizer. It is also used in glass and ceramic industries and it is also used to produce lime needed to construct buildings.

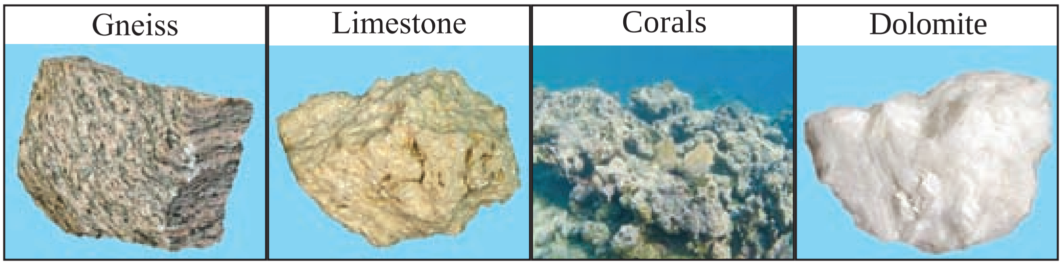


Fig. 2.3 Different varieties of rocks

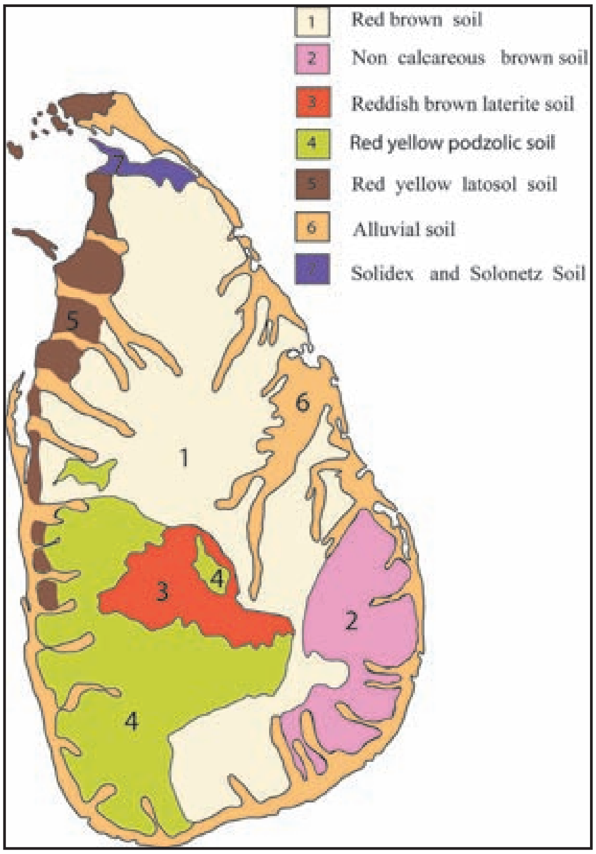
Problems in utilization of rocks.

- Environmental pollution due to excavation and transportation of rocks.
- Coastal erosion and the flooding caused by sea.
- Occurrence of landslides and cracks on buildings caused by vibrations during excavations.
- Barren lands which are unsuitable for cultivation.

Soil of Sri Lanka

Soil is formed by weathering of parent rocks and decomposition of animal and plant matter. Factors such as climate, parent rock, vegetation cover and slope land areas are important in the formation of soil. The quantity of rainfall and the period of receiving rainfall are the most important factors that help in the development process of soil in Sri Lanka. Constant rainfall and high temperature expedite the weathering process of rocks. Although Sri Lanka is a small island, a number of soil types are found due to the influence of various factors. In this chapter we discuss seven main soil Groups in Sri Lanka.

- Red brown soil
- Non calcareous brown soil
- Reddish brown latosol soil
- Red yellow podzolic soil
- Red yellow latosol soil
- Alluvial soil
- Solidex and Solonetz soil.



Map 2.1 - Distribution of soils in Sri Lanka

How to use the soil:

- **Red brown soil** - It is found only in the Dry Zone and is suitable for cultivation of dry crops and Chena cultivation
- **Non calcareous brown soil** - It is found in the interior areas of Ampara , Batticaloa and in the coastal areas. This is more suitable for the cultivation of grains, vegetables and grasses.
- **Reddish brown laterite soil** - It is commonly found in the Wet Zone. This is more suitable for the cultivation of tea, rubber, coffee, cocoa, cardamoms, cloves and fruits.
- **Red yellow podzolic soil** - This soil is found in the districts that belong to the low country wet zone. Tea, rubber, coconut are some permanent crops which can be grown in this area. This is also suitable for growing vegetables and fruits.
- **Red yellow latosol soil** - This can be seen in the land area from Putalam to Mullaitivu along the North Western coast of the Dry Zone, and in the Jaffna peninsula. This could be made suitable for fruit cultivation successfully with the use of fertilizers and proper water supply.
- **Alluvial soil** - It is spread in river valleys and areas around them in the wet and dry zones. It is commonly used for paddy cultivation.
- **Solidex and Solonetz Soil** - This kind of soil is abundantly found in areas such as Damana and Tamankaduwa. Suitable for paddy and grasses.

Problems in utilization of soil and methods of conservation

Problems	Methods of conservation of soil.
• Severe soil erosion. • Salinity of soil. • Reduction of the capacity to retain water in soil. • Reduction of fertility due to over exposure of land. • Land degradation due to chemical Fertilizers, pesticides and weedicides. • Occurrence of natural disasters such as floods and landslides. • Effect on the ground water stores. • Soil organisms get destroyed.	• Select crops following the agricultural principles and manage accordingly. • Regulating the use of fertilizer and improving the consumption of organic fertilizers. • Cultivating cover crops. • Turn over the soil according to contour lines in slopes. • Stripe cultivation method. • Use crop residues as fertilizer. • Use block and spill drains slit drains and green fence. And the use of stone ridges.

Activities

01. List the main kinds of rocks and write two examples for each type.

02. Name the main categories of soil in Sri Lanka and make a list of crops that can be grown in each type of soil.

03. Mark the areas where those varieties of soil are spread in a map of Sri Lanka.

Minerals

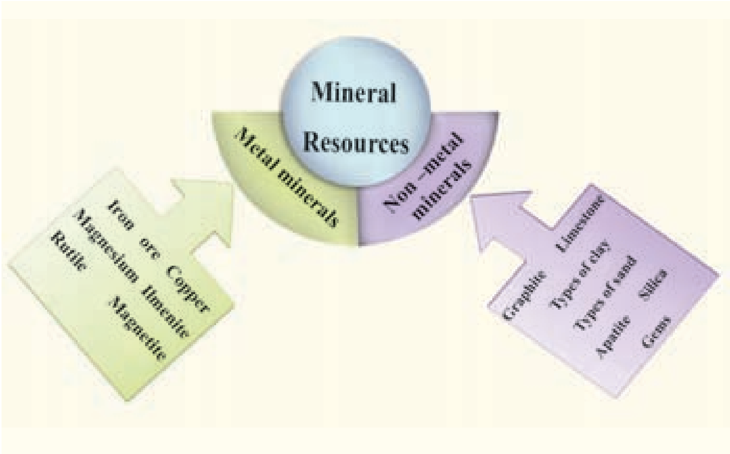
Mineral resources can be introduced as a gift of nature. Graphite, gems, clay, limestone and mineral sand are the main kinds of mineral in Sri Lanka.

These minerals and the products related to them are used at different occasions in day to day life. Fig 2.4 shows some of the goods produced using these minerals.



Fig. 2 .4 - Products related to minerals.

Mineral resources in Sri Lanka are of two categories. They are Metal minerals and Non - metal minerals.



Graphite

Sri Lanka is famous for high quality graphite since past. Graphite is mainly exported and is used in following local industries.

- To produce paints
- To make casting moulds
- To plate ovens
- In the printing industry
- Used in electric and electronic industry
- To produce pencils
- To produce explosives

Kahatagaha and Kolongaha in Kurunegala district and Bogala in Kegalle district are two main areas in Sri Lanka where graphite is found. Kolonne, Bothale, Meegoda, Kahatagasdigiliya, Kebithigollawa, Akuressa, Batapola and Deniyaya are the other areas where graphite is found.



Fig. 2 .2 - The distribution of graphite and gems in Sri Lanka

Gems

Sri Lanka is famous for gems since ancient times and it is the type of material that brings in the largest amount of foreign currency to Sri Lanka. Gems are unique because of their lustre, colour and hardness. Sri Lanka has different varieties of gems such as rubies, sapphires , cat's eye, tourmaline etc. Which are highly valuable. Uses of gems are;

- Used in making jewellery
- Making watch bearings
- Making ornaments.

Activities

01. Mark three areas where gems and graphite are distributed in a map of Sri Lanka marked with district boundaries.

02. Name the industries related to gems and graphite industry and state the benefits we can get by developing those industries.

Mineral sands

Mineral sands used as raw materials for different industries are found in abundance in the coastal areas and river banks in Sri Lanka. Silica, Ilmenite, Zircon and Rutile are some of the important mineral sands.

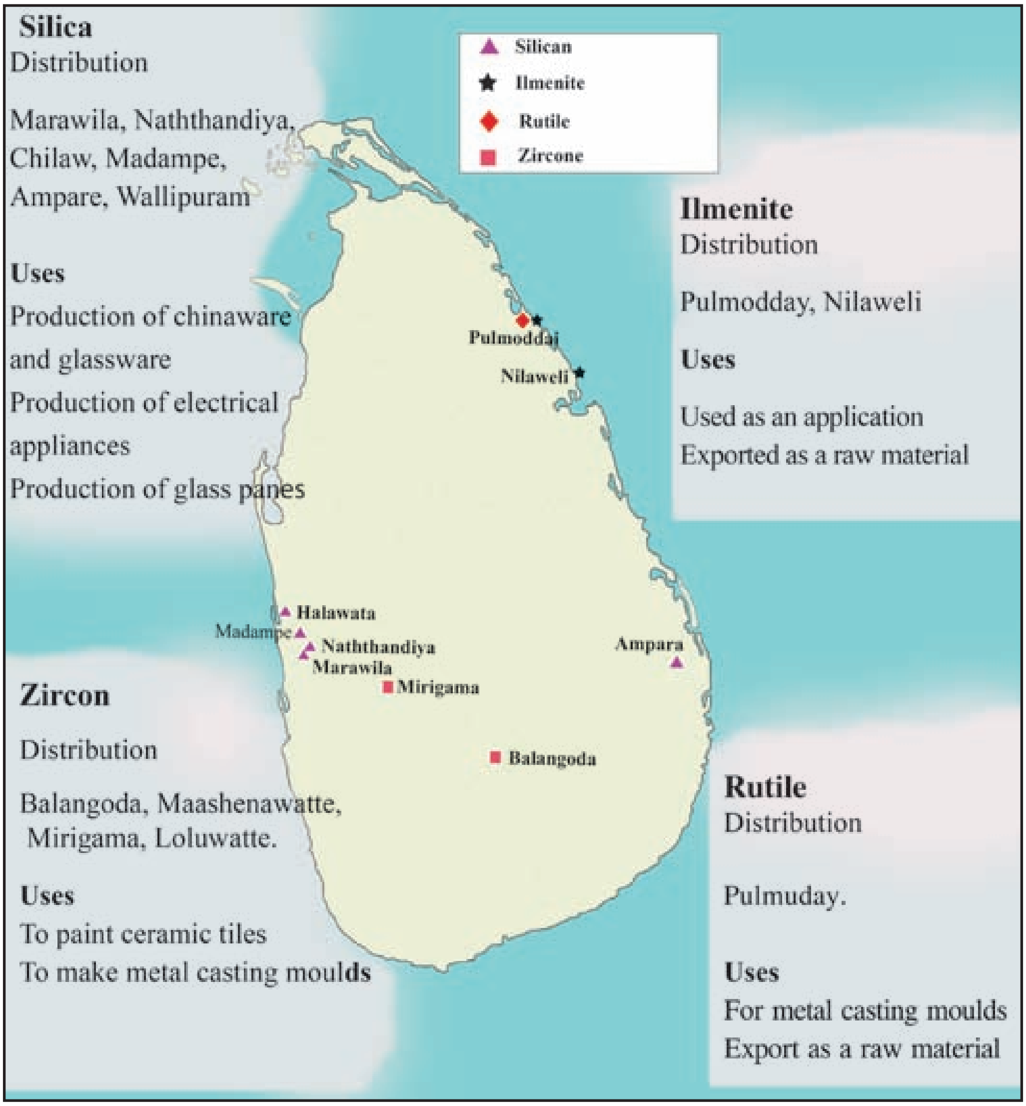


Fig. 2.2 - Distributing of mineral sands

Activities

01. Name four types of mineral sands in Sri Lanka.

02. Mark and name the areas where they are spread in a map of Sri Lanka.

03. Cite with examples and explain the importance of mineral sands as an industrial raw material in Sri Lanka.

Problems in utilization of Mineral resources

- Environment pollution due to technical methods used in mining mineral resources.
- Sand mining in river valleys would cause erosion of river banks, floods, destruction of cultivation due to flow of salinized water to the interior of the country.
- Pits are created due to mining and earth slips and landslides may occur too.
- Unused pits filled with water for a long time become breeding grounds for mosquitos and bacteria.
- Floods occur due to deposition of sediments in rivers and lakes.
- Mining can be harmful to trees and plants in the environment, destruction of cultivated lands, water, land and air pollution.
- Destruction of aquatic organisms and soil organisms.

Conservation of Mineral resources

Mineral resources should be conserved because they are exhaustible resources. Steps taken to conserve mineral resources are as follows:

- Issuing of licenses to regularize mineral mining.
- Taking the maximum use of the resources available.
- Regularizing laws for mining, using and transportation of minerals.
- Minimizing wastage when mining.
- Exploring to discover potential mineral resources.
- Improving efficiency in technology.

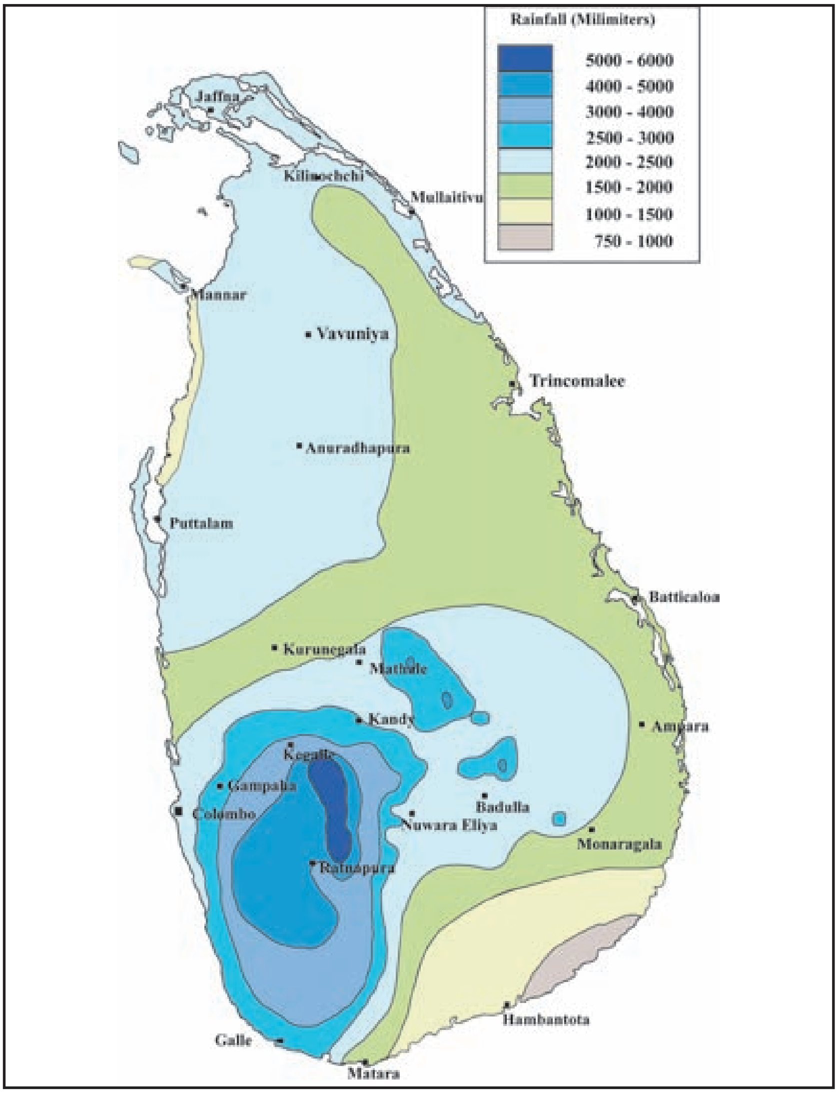
Activities

01. Name the minerals used as industrial raw materials in Sri Lanka.

02.‘Mineral is a resource that should be conserved” . Give reasons for that.

Water

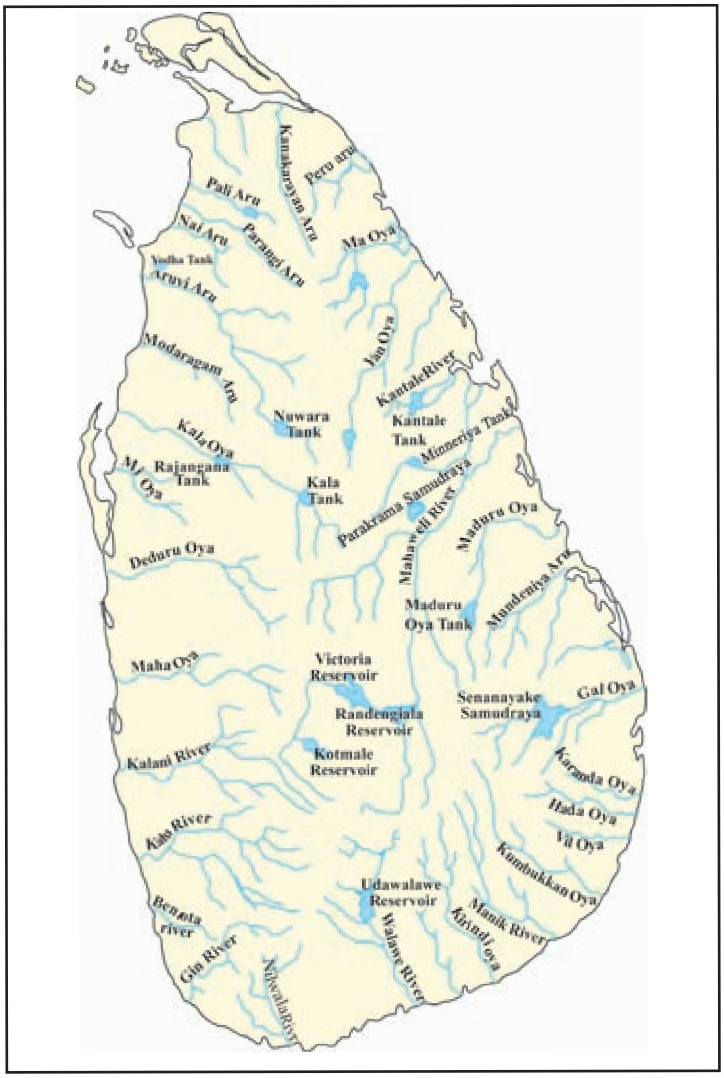
Sri Lanka is a country with abundant water resources. Sources of water in Sri Lanka are mainly fed by rainfall. Sri Lanka receives rainfall from monsoons, convectional rain and cyclones. The map in figure 2.4 shows the distribution of average annual rainfall in Sri Lanka. It clearly shows that the amount of rainfall varies in different places.



Map 2.4 - Distribution of rainfall in Sri Lanka.

Main water resources in Sri Lanka are,

- Rivers, streams
- Tanks, reservoirs
- ground water (wells, springs, tube wells)



Map 2.5 - Rivers in Sri Lanka

Rivers, streams and canals

Even though Sri Lanka is a small island, it has about 103 river valleys (Map 2.5). Water from these rivers is utilized to fulfil the basic water requirements of the country. The earliest settlements were established in these river valleys to obtain water for their needs.

Tanks and reservoirs

Attention was paid on irrigation in the dry zone, even in the ancient times, due to instability of rainfall and drying up of the rivers during the dry season.

Many tanks were constructed in the Dry Zone in Sri Lanka as a solution for the scarcity of water. Water collected during the rainy season in these tanks is used during the dry season. Minneriya , Kavudulla, Parakrama Samudra, Yoda wewa, Kala wewa and Nachchaduwa are examples for some of the tanks in the dry zone. These tanks fulfill the water requirements in those areas even at present.

Large reservoirs were constructed in the hill country wet zone during recent times. Kothmale, Victoria, Randenigala and Rantambe are some of them. Water in these reservoirs is not only used for agriculture, but for many other purposes as well.

Ground water

Ground water is important in districts such as Jaffna, Kilinochchi, Mannar, and Puttalam in Sri Lanka. Limestone deposits of these areas can retain a large quantity of ground water. Ground water exists as deep basins. Vanathavilluwa and Murukkan basins are the largest ground water deposits in the island. Ground water can be utilized by agri wells, tube wells and Andiya wells (a well with a counterpoise bucket lift. They are also known as "sweep well.)

Uses of water

- For drinking and household consumption.
- Generation of hydro – electricity.
- In agriculture.
- For recreational activities
- For industrial productions.
- As a medium of transport.
- For the fishing industry.
- To protect the balance of nature and to control the temperature.

Problems in utilization of water

- Water is a scarce resource.
- Waste of water.
- Pollution of water due to agriculture and industrial waste.
- Scarcity of pure drinking water.
- Breeding of pathogenic organisms in contaminated water.
- Problems in distribution of water during droughts.
- Pollution of water sources, salinization.
- Drying of springs, water pollution in tube wells.

Methods of conservation of water sources

- Implement water management plans.
- Use water sparingly and minimize wastage.

- Protect water sources in the catchment areas.
- Construct large tanks and reservoirs.
- Provide proper irrigation to agricultural lands.
- Use of rainwater tanks. (Rainwater harvesting)
- Recycle water.
- Make people aware of the value of water.
- Minimize water pollution.
- Regularize the method of releasing waste matter into the waterways
- Controlling floods.
- Design equipment like taps in a suitable way to help conservation of water.

Activities

01. Following are 10 main river valleys in Sri Lanka. Mark and name them in a map of Sri Lanka.

Mahaweli river	Yan Oya	Kelani river	Walawe River
Deduru Oya	Kumbukkan Oya	Kalu ganga	Ginganga
Malwatu Oya	Maduru oya		

02. Explain the statement, “Water is an essential resource for survival of the living organisms.

Forests in Sri Lanka

Many sub systems can be identified when we study the forests in Sri Lanka. Following are those sub systems of forests.

- Tropical Rain Forests
- Dry Mixed Evergreen Forests
- Intermediate Evergreen Forests
- Montane Dry Zone Forests
- Montane Wet Zone Forests
- Thorn and Scrubland (Arid Zone Forests)
- Mangroves

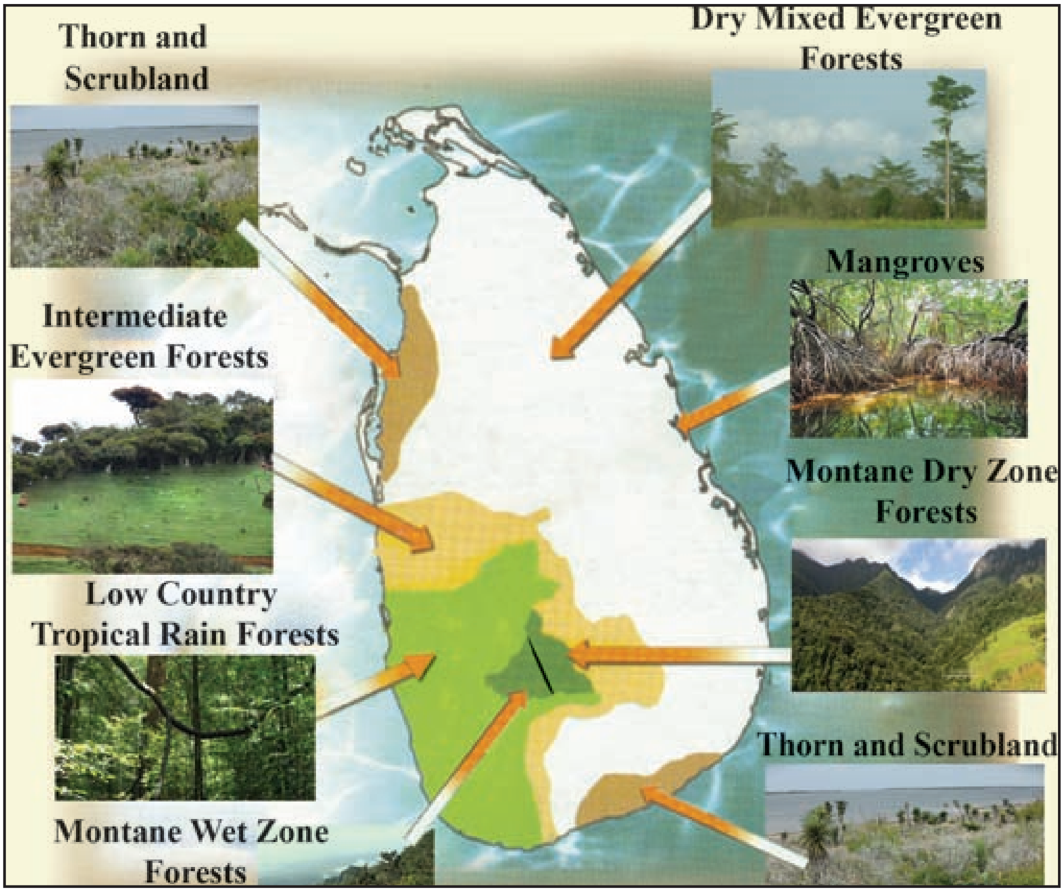


Fig. 2.5 – Distribution of forests in Sri Lanka

Tropical Rain Forests

- Distributed in the lower areas of the wet zone and in the hill country of Sri Lanka . Dediyagala, Kanneliya, Nakiyadeniya, Ruhunu Kanda, Gilimale, Erathna and Morapitiya are areas where these kinds of forests are found.
- Constant rainfall and a temperature favourable for the growth of plants throughout the year is a special feature in these forests.
- Forests are dark green in colour and trees are found in different layers. Under growth is abundant. Hard wood trees can also be seen among the other common trees.
- Hora, Keena, Godapara, Kirihembiliya, Batu Na, Milla, Midella Nedun, Davata are some of the common trees in these forests.



Fig. 2.6 - Tropical Rain Forests

Dry Mixed Evergreen Forests

- Distributed mainly in the dry zone
- The main rainy season is Northeast monsoon and trees grow during that period.
- As trees grow during the rainy season and in certain kinds of trees, leaves fall during the dry season, these forests are Deciduous Forests.
- Trees of economic value such as Satinwood, Ebony, Milla, Suriyamara, Teak and Halmilla can be seen in these forests in abundance.



Fig. 2.7 - Dry Mixed Ever Green Forests

Intermediate Evergreen Forests

- Spreads along the transitional zone which separates the wet and dry zone.
- Trees of dry and wet zone are mixed up.
- The predominant types of trees are Jak, Bedidel, Pihimbiya, Mahogany, Lunumidella.

Montane Wet Zone Forests

- Distributed in hill country wet zone above 1200 m in height. Samanala, Pidurutalagala, Horton plain, Knuckles are some of the areas where these forests are found.
- Height of trees gradually decreases according to the altitude of the land. Tree tops grow as a canopy. Trees do not grow thickly. Epiphytes are abundant on tree trunks.



Fig. 2.8 - Montane wetzone Forests

- Sapu, Keena, Mihiriya, Waldel, Vellan, Mora, Hulan hik are some of the predominant types of trees in these forests.

Montane Dry Zone Forests

- Distributed in hilly areas over 1400m in height.
- Horton plains, Moon plains, Seethaeliya, Ambewela, Kandapola are some of the areas these forests are found in abundance.
- A significant feature is 'Patanas' or grasslands as a result of less rainfall. The

trunks and the branches of the trees are twisted so that they are resistant to strong winds prevalent in these areas. Trees are scattered about in the grasslands.

- Maharathamal, Aralu, Bula, Nelli, Domba, Gurukeena and Kahata are some predominant types of trees found in these forests.



Fig. 2.9 - Montane Dry Zone Forests

Thorn and Scrubland

- These are found in the Northwestern and South Eastern regions.

- The average temperature is above 27^c. Therefore plants are adapted to withstand droughts. Thorny trees with pointed and thick leaves can be seen (cactus).

- Palu, Weera, Eraminiya, Karamba, Suriya are examples for the types of trees that can be seen in abundance in these forests.



Fig. 2.10 - Thorn and Scrubland

Mangroves

- These are distributed in the coastal areas near rivers, river mouths and lagoons.
- A distinctive feature of mangroves is their far-reaching, exposed roots.
- Kadol, Kirala, Diyakaduru, Ginpol are some species of trees abundantly found.



Fig. 2.11 - Mangroves

Wildlife reserves

Animals in the forests are an important part of the bio-diversity. Forest reserves are declared to protect eco systems and fauna, to preserve natural beauty

and to provide opportunities for scientific research. Following are some types of reserves.

- National Parks
- Sanctuaries
- Forest reserves
- Strict natural reserves
- Natural reserves

National Parks

There are about 20 national parks in Sri Lanka. Yala, Wilpattu, Gal oya, Kumana, Udawalawa, Vasgamuwa, Lunugam Vehera, Maduru Oya, Somawathie, Horton Plains, Bundala, Minneriya are some of them. The wildlife is completely protected in these national parks. The public can observe the wildlife and the natural environment. Provisions for scientific study are also provided.

Strict Natural Reserves

Haggala, Yala and Ritigala are three of the strict natural reserves. Human activities are restricted in these reserves. Wildlife resources are solely owned by the government and the public is permitted to enter these areas only for scientific research purposes.

Sanctuaries

It is an area reserved for the protection of wildlife. There are about 62 sanctuaries in Sri Lanka. Weeravilla, Kataragama, Kaudulla, Minneriya, Udawatta Kale, Wilapattu, Gal Oya, Trincomalee, Madhu road, Ravana Ella, Victoria, Randenigala, Rantambe, Sigiriya, Bellanvilla, Madunagala are some of the main sanctuaries in Sri Lanka. Sanctuaries are not under severe restrictions. Human activities are permitted in such a way to protect wildlife and their natural habitats.

Nature Reserves

Thriconamadhu, Minneriya, Giritale, Wetahiriyakanda are some of the Nature Reserves in Sri Lanka. The government assures protection of living and non- living resources in these areas. Public cannot enter these areas without permission of the government.

Forest Reserves

Knuckles, Sinharaja, Kanneliya, Dediyagala and Nakiyadeniya are some of the main forest reserves.

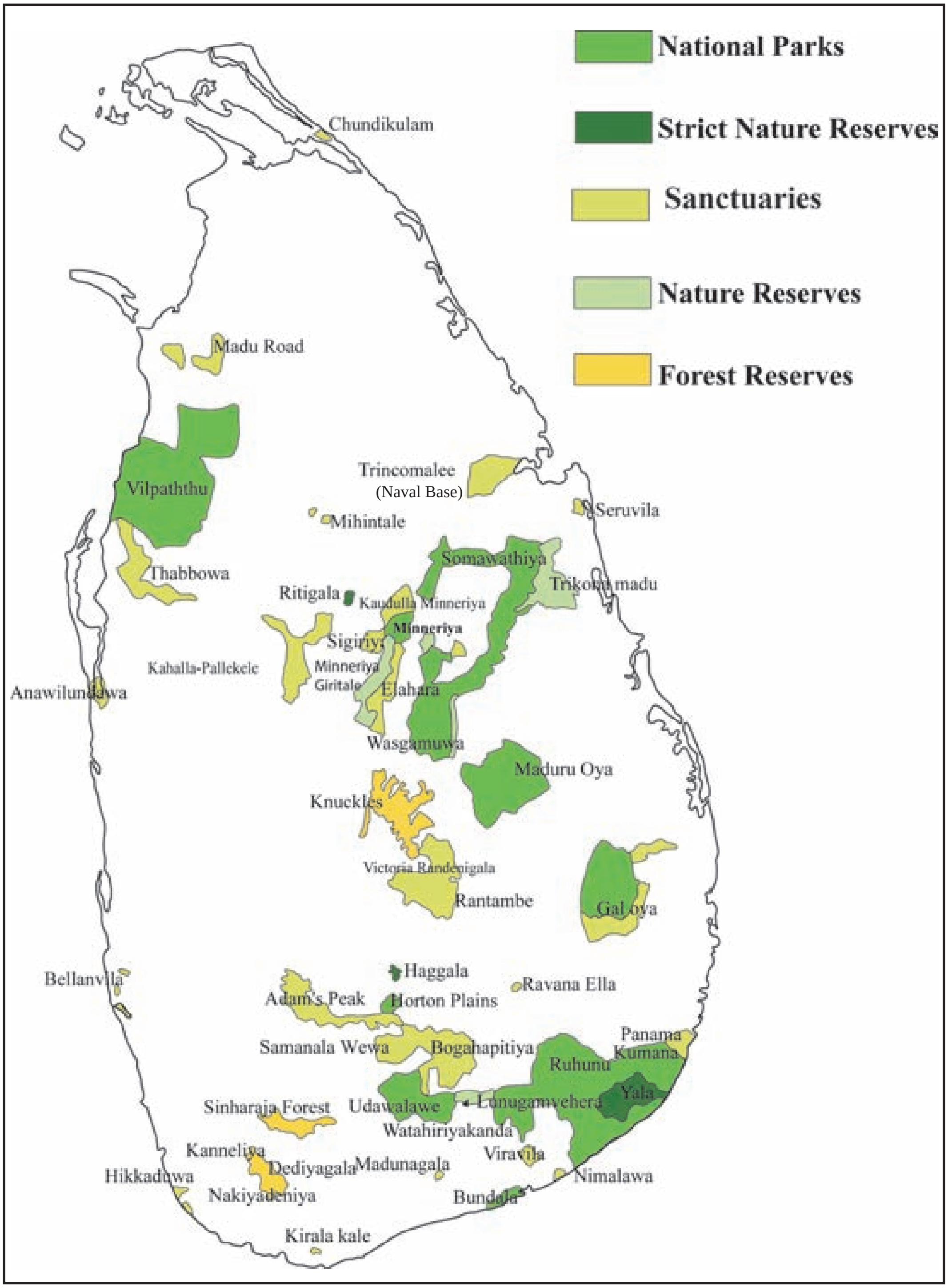


Fig. 2.6 - Forest Reserves in Sri Lanka
Source - *The National Map collection of Sri Lanka 2007*

Uses of forests and forest reserves

- They protect bio- diversity.
- Provides a sanctuary for wildlife.
- Provides an opportunity for the public to observe rare wildlife.
- Springs and catchment areas are conserved.
- Prevent the increase of environmental temperature.
- They act as a gene pool.
- It is a source that provides food and medicine.
- Provide commercial products such as resin, wax, paraffin, kithul treackle and bee honey.
- Prevent environment pollution.
- Absorb Carbon dioxide.
- Provision of timber to build houses and to make furniture. Provide firewood to be used as a fuel.
- Give shade, coolness, beautify nature and give mental relief.
- Act as a buffer for soil erosion and conserve soil.
- Storms, earth slips and floods are controlled.

Activities

01. Mark and name two National parks, Strict Natural Reserves, Sanctuaries, Natural reserves and Forest reserves in a map of Sri Lanka.

02. Create a folder about forests in Sri Lanka under the following topics.
    - Distribution of forests
    - Nature of trees and plants
    - Significance of forests and wildlife in Sri Lanka

Steps taken to conserve forests

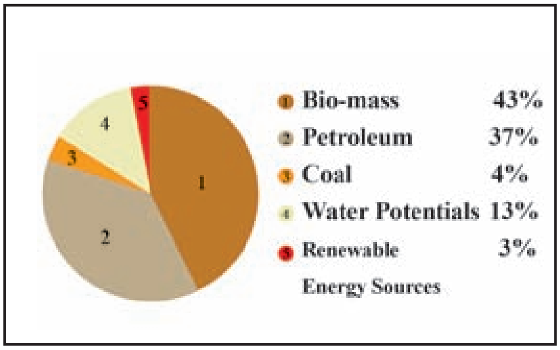
Threats to the existence of forests have increased in line with increase in population and their escalating needs. Deforestation that occur along with the increase in population has adverse effects on climate, environment, and human life and on wild life too. Therefore following steps were taken to conserve forests and wild life.

- Maintaining National Reserves and Sanctuaries.
- Implementing forest plantation projects.
- Following forest conservation strategies (SALT method, conserve wet lands, conserve mangroves).
- Encouraging public participation in a forestation.
- Planting trees and increase the productivity of forests.
- Making people aware of the effects of destruction of forests.
- Maintenance of Environmentally Sensitive Zones.
- Protecting forest resources and enforcing the existing laws.

Energy Power

There are several sources used to generate energy power,

- Bio- mass
- Imported petroleum
- Water
- Coal
- Wind
- Solar energy



Graph 2.1 - Use of Energy use in Sri Lanka
Source - *http://www.info.energy.gov.lk/2015/04/23*

Graph 2.1 shows how these sources of power produce energy in Sri Lanka. According to the graph; it is evident that bio-mass and petroleum are used more than the other sources of energy.

Bio- mass

Timber, Agri waste, animal waste and bio gas are the main bio-mass energy sources used in Sri Lanka. Sri Lanka uses fire wood in abundance like many of the other developing countries. Fire wood from home gardens, fire wood from coconut cultivations, rubber wood, wood from natural forests and forest cultivations are used as fuel. Other than the above sources, saw dust, paddy husks, fiber waste of sugarcane, charcoal and charcoal obtained from coconut shells are also used as fuel.

Solar energy

Solar energy can be produced easily in Sri Lanka as it is located in the tropical region which gets constant sun light. Sri Lanka has recently established a solar power station at Baruthakanda in Hambanthota .Other than that solar cells and solar panels are used for producing energy for domestic use. The high capital required to be invested initially to obtain solar power is a challenge to a developing country like Sri Lanka. However it is a source of energy which immensely helps to reduce environmental pollution.

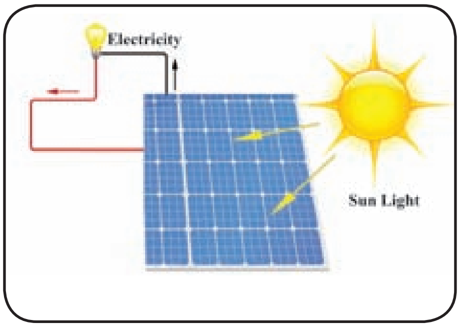


Fig. 2.12 - Solar panel

Wind energy

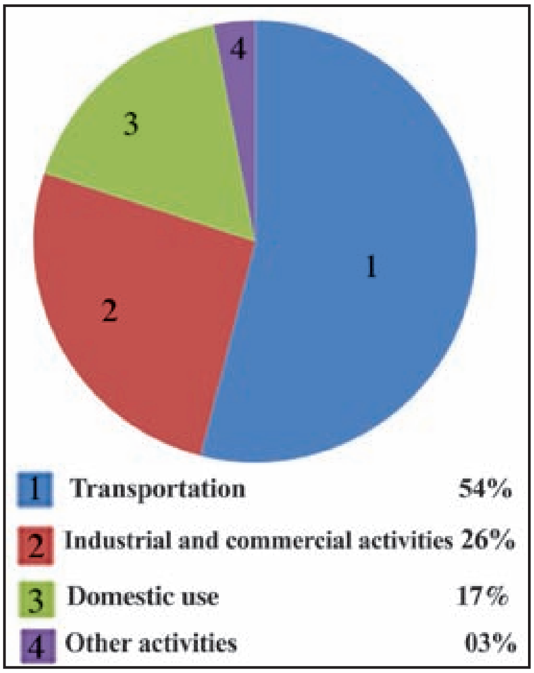
Wind is an important source of energy as it is a non-exhaustible resource. Similar to the way of utilizing solar energy wind power too requires a higher initial capital. But it causes the minimum level of environmental pollution. Puttalam and Hambanthota are the areas where wind power stations are located in Sri Lanka. They supply power to small scale industries



Fig. 2.13 - Wind Mills

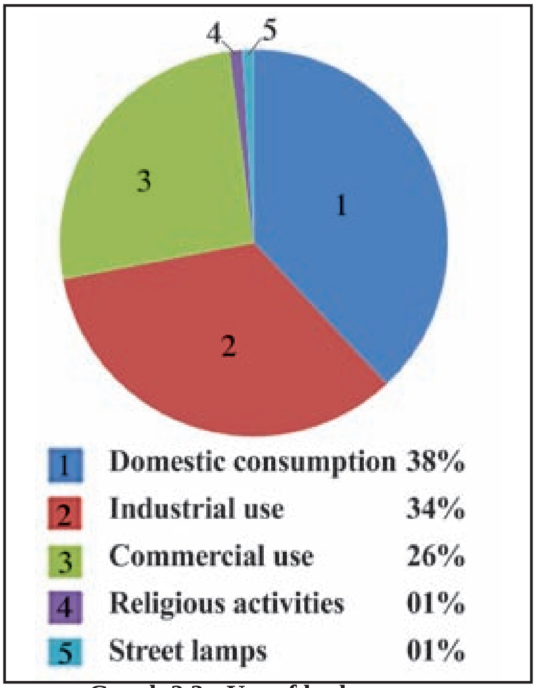
Petroleum

Petroleum is an important source of energy which is imported. Imported crude oil is being purified at Sapugakanda and is distributed throughout the country by the Kolonnawa stores. Petrol, Diesel, L.P. Gas, Jet fuel, Fuel oil and Kerosene oil are extracted from crude oil. Graph 2.2 shows how petroleum is consumed in Sri Lanka. According to this graph it is clear that petroleum is used mostly in transportation, industries and commercial activities.



Graph 2.2 - Use of petroleum

Source - *Anuual report 2013 Ministry of Finance and Planning*



Graph 2.3 - Use of hydro power

Source - *http://www.info.energy.gov.*

The demand for energy is increasing day by day in Sri Lanka. "Sustainable Energy Authority" is established to fulfil this demand and to concentrate on producing low cost energy generation. Attention is paid to establish small scale energy projects in the rural areas. In addition to the above, energy power is produced at the coal power stations in Kerawalaptiya and Norochcholai.

Hydro electricity

Hydro electricity is mostly used for domestic, industrial and commercial activities in Sri Lanka. Only 2000 mega watts can be produced in hydro power stations in Sri Lanka. Lakshapana,Wimalasurendra, Samanala, Canyon, Randenigala, Kothmale, Victoria, Ukuwela are some hydro power stations which produce 1200 mega watts up to now.

The demand for electricity increases annually by 7% - 8% in Sri Lanka. Increase in the population, rise in consumer needs and development in industries have affected this increase in demand for energy. Graph 2.2 shows the consumption of electricity in Sri Lanka. According to this graph, there is a high demand for domestic activities and industries.

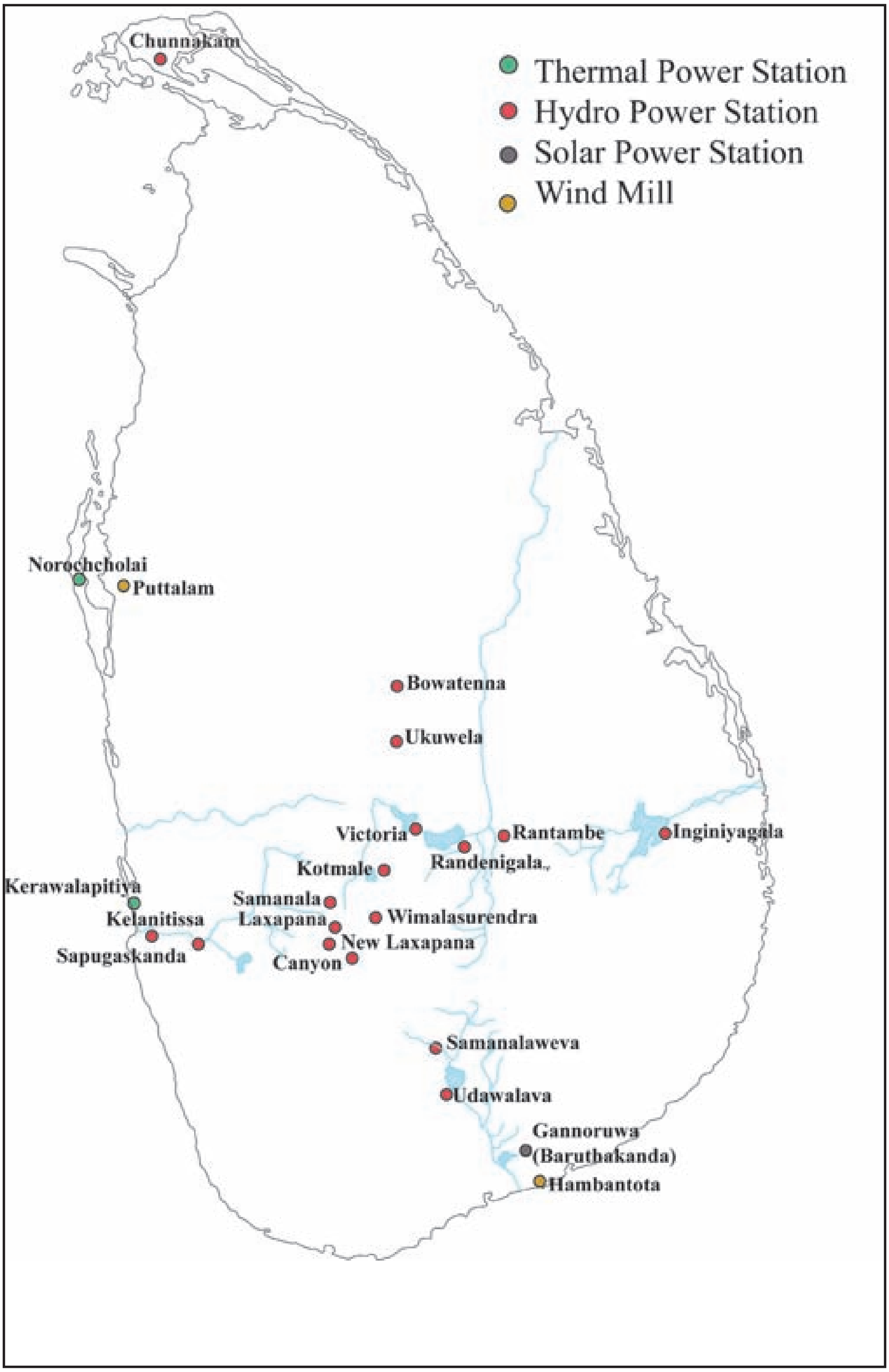


Fig. 2.7 - Hydro Power Station in Sri Lanka

Source - *Gunasena Philhips Atlas (2003)*

Problems in consumption of energy sources

- High cost.
- Some of the energy sources like wind and solar power depends on environmental factors and a high initial cost has to be spent.
- A high cost is spent for importing crude oil.
- More wastage in consumption of energy.
- Breakdowns due to natural hazards.

Importance of the conservation of energy resources

- Saves foreign currency that we spend on importing crude oil.
- Contribution to the development of the country.
- Contribution to the education and social activities.
- Consumption of energy sources sparingly would help to fulfill high demands. It would also contribute towards sustainable development.
- Efficiency in daily activities of the consumers saves time and minimizes the waste of money.
- Minimize environmental destruction.
- Minimize the effects of natural hazards and climatic changes.

Activity

1. Name three energy sources used mostly in Sri Lanka.
2. Mark and name the following things on a map of Sri Lanka.
   - Five main hydro power stations
   - Two wind power stations
   - A coal power station
3. "We can contribute to the development of the country by using energy power sparingly" Explain this statement with examples.

Assignments

1. List three problems related to consumption of land in your area.
2. Design a leaflet including methods that can be followed to solve those problems.
3. (i) Name some of the mineral resources in your area and prepare a table and write their uses.

   (ii) Find information about the advance effects of extracting and using those mineral resources on the environment.
4. (i) Collect data on problems related to consumption of water in your area.

   (ii) Suggest remedies to solve those problems.
5. Plan and implement an activity to use the water wasted in the school premises with the help of your teacher.
6. (i) To which sub system are the forests in your area belong?

   (ii) Write three special features of those forests.
7. Collect data on natural resources in your area. Make a handout to show the uses gained at present and uses that can be gained in future.

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Glossary

- Maritime boundary - මුහුදු සීමාව - கடல் எல்லை
- Nautical miles - නාවික සැතපුම් - கடல் மைல்
- Territorial Maritime boundary - රාජ්‍ය මුහුදු සීමාව - ஆட்புல கடல் எல்லை

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- Scrub lands - ලඳු කැළෑ - பற்றைக் காடுகள்
- Terraced method - හෙල්මළු ක්‍රමය - படிக்கட்டு முறை
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- Coral reefs - හිරිගල් පර - முருகைக் கற்பார்
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- Forest reserves - වන රක්ෂිත - வன ஒதுக்கு
- Gene pool - ජාන සංචිත - மரபணு
- Storms - සුළං කුණාටු - புயல்கள்
- Tree culture - රුක් රෝපණය - மரநடுகை
- Environmentally sensitive zones - පරිසර සංවේදී කලාප - சூழல் உணர்திறன் வலயம்
- Bio mass - ජෛව ස්කන්ධ - உயிர் திணிவு
- Solar energy - සූර්ය ශක්තිය - சூரிய சக்தி
- Solar power stations - සූර්ය බලාගාර - சூரிய வலு நிலையம்
- Solar cells - සූර්ය කෝෂ - சூரியக் கலங்கள்
- Solar panel - සූර්ය පැනලය - சூரிய தொகுதி
- Generation of electricity - විදුලිය ජනනය කිරීම - மின் உருவாக்கம்
- Energy Authority - බලශක්ති අධිකාරිය - மின் சக்தி ஆணைக் குழு
- Coal power station - ගල් අඟුරු බලාගාරය - நிலக்கரி வலு நிலையம்
- Sustainable existence - තිරසර පැවැත්ම - நிலையான வாழ்வு திறன்

Scientific names of the trees in Sri Lankan forests mentioned in Unit 2

- Hora - *Dipterocarpus zeylanicus*
- Keena - *Callophylum tomentosum*
- Halmilla - *Berrya cordifolia*
- Kirihambiliya - *Palaquium grande*
- Milla - *Vitex altissima*
- Nadun - *Pericopsis mooniana*
- Pihibiya - *Filicium decipiens*
- Lunumidella - *Melia azedarach*
- Sapu - *Michelia champaca*
- Nelli - *Phyllanthus emblica*
- Palu - *Manilkara hexandra*
- Karamba - *Carissa carandas*
- Suriya - *Thespesia populnea*
- Eraminiya - *Ziziphus rugosa*
- Mora - *Dimocarpus longan*
- Kaluwara - *Diospyrus ebenum*
- Burutha - *Chloroxylon swietenia*
- Teak - *Tectonia grandis*
- Suriya mara - *Albizia odoratissima*
- Badi del - *Artocarpus nobilis*
- Hulan hik - *Chukrasia tabularis*
- Mihiriya - *Gordonia ceylanica*
- Maha rath mal - *Rhodendron arboreum*

- Aralu - *Terminalia chebula*
- Bulu - *Terminalia bellirica*
- Domba - *Callophylum innophylum*
- Guru keena - *Calophyllum calaba*
- Kadol - *Rhizophora mucronata*
- Kirala - *Sonneratia caseolaris*
- Diya kaduru - *Cerbera manghas*
- Gin pol - *Nypa futicans*
- Welan - *Pterospermum suberifolium*
- Midella - *Barringtonia racemosa*
- Dawata - *Carallia brachiata*
- Kahata - *Careya arborea*
- Veera - *Drypetes sepiaria*

3 The World Population

The total number of humans inhabiting the earth is termed population



Fig. 3.1 - Population

Population is defined as a phenomenon that changes qualitatively and quantitatively.

The main objective of this lesson is to find out information regarding the size of population, its growth and distribution.

When population is considered two important aspects can be identified,

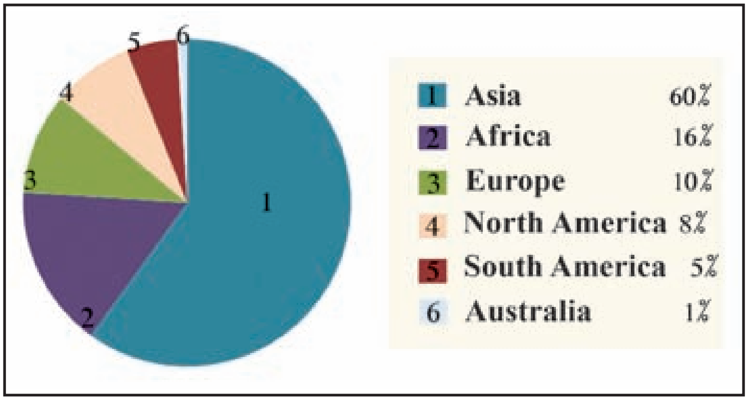
- Features such as gender, human race and age that receive at birth.
- Features such as nationality, religion, language and literacy that are received later.

Man who determines or consumes all physical resources on the earth is a resource. Accordingly, in any country human resource is very important within the development process. It is so because all activities of the world is based on man. The population of the world is growing fast. The accelerated growth of population in some countries is a problem and in others, the lower growth of population is also a problem. In developing countries the growth of population is relatively faster than in developed countries. Hence it is important that the population has to be

maintained at the optimum level in any country, within the development process. For this purpose, it is seen that in every country, various strategies and plans are prepared and also population polices are followed. Hence "population" has become a very important topic in geographical studies.

The size of world population

Over 200 years ago, the world population has been very low, however, at present the world population has risen beyond seven billion. Gradually according to the rate that population growth increases, it can be calculated that around 80 million people would be added to the world population.



Graph 3.1 The World Population size (prepared according to continents)

Source – *http://world population rewiew.com/continents 2014.12.03*

Graph 3.1 Shows the distribution of population in the continents. According to this graph;

- around 76%of the total world population lives in the two continents of Asia and Africa. 24%, comprising the rest, is distributed among other countries. There are around 23 countries which have a population of over a 100 million. The 10 countries which have the largest populations is shown in table 3.1.

- China and India in Asia are homes to a huge population. Besides, high populations are found in Pakistan, Bangladesh and Indonesia.

Table -3.1 Population according to the numerical strength

Country	Population	Percentage
China	1,393,783,836	19.24
India	1,267,401,849	17.50
U.S.A	322,583,006	4.45
Indonesia	252,812,245	3.49
Brazil	202,033,670	2.79
Pakistan	185,132,926	2.56
Nigeria	178,516,904	2.46
Bangladesh	158,512,570	2.19
Russia	142,467,651	1.97
Japan	126,999,808	1.75

Source - *http://www.worldometers.info/2015.07.20*

The Growth of World Population

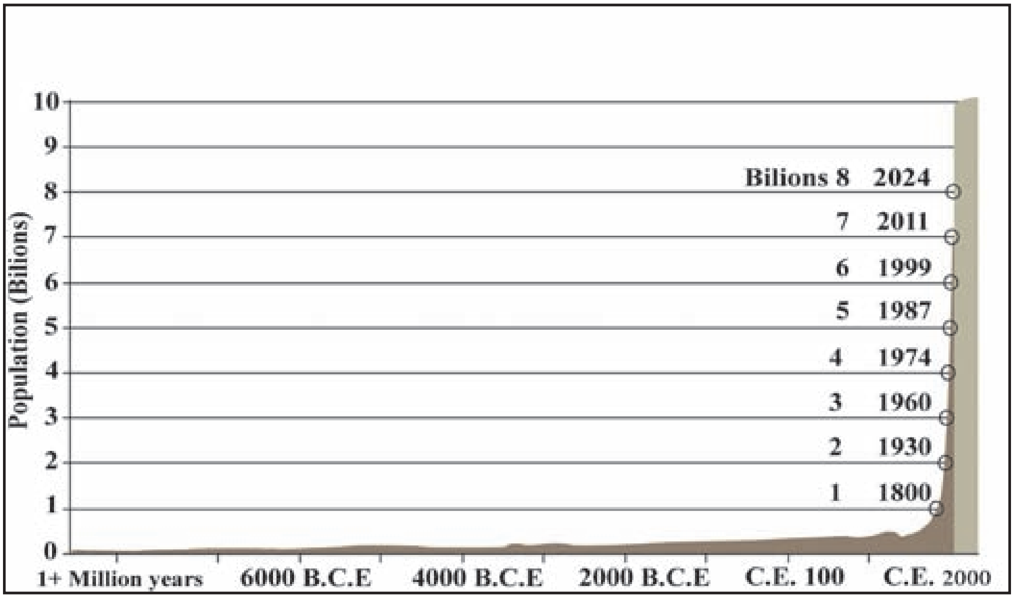
Though the history of human race that inhabited the world runs to over a million years, definite data about population have not been found prior to last 200 years.

Some conclusions have been arrived at, by means of archaeological evidence about the early period. Even during this period by examining the data it becomes clear that there has been a continuous growth of the world population.

When the historical data regarding world population, two distinguishable periods can be identified.

1. A long period of time between the origin of mankind to around 1750 when the growth was slow.

During a long period of time due to the rate of natural growth being at a low level, the world population did not develop fast. The reason behind this is the fact that though the birth ratio was high, the mortality ratio too remained high. See graph 3.2.



Graph 3.2 - **How world population grew**

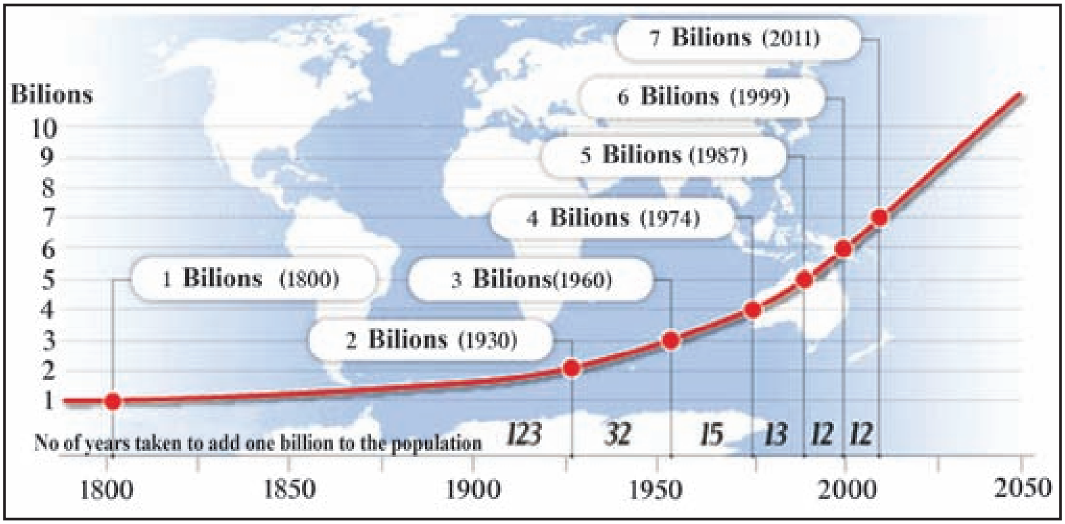
Source - *http://singularity.com/wp/_contend/uphold/2011/09/image2.jpg 2015.07*

Within the short period after 1750 AD, There was an accelerated growth of population. During this period of time the mortality rate became low but the birth rate remained high, leading to an accelerated growth in population. This is known as the population explosion.

Table 3.2 Rapid Growth in Population

Year	Population in millions
1750	700
1800	1,000
1850	1,200
1900	1,600
1950	2,550
1975	4,000
1985	4,850
1995	5,700
2006	6,500
2009	6,800
2011	7,000

Source – *http://geography.about.com 2015.07.22*

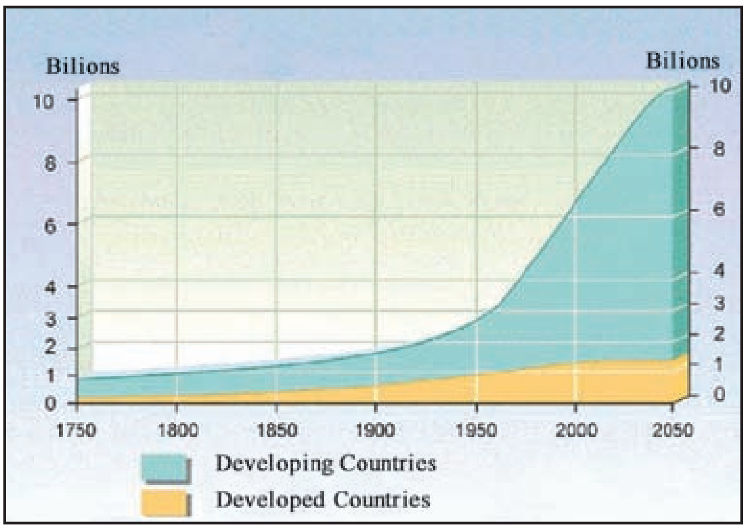


Graph 3.3 – The time taken for the growth of world population from billion to billion

Source - *http://www.usfunds.com/media/images 2014.12.06*

The world population which was a billion in 1800 had reached seven billion in AD in 2011. According to graph 3.3 it is clear, that gradually the time taken for growth of population to near a billion became less and at the present time it has only taken a short period of time like 12 years for the population to double. It is expected for the world population to reach 11 billion at the end of this century.

Another special feature of the growth of world population is the fact that during the period after 1950, the population growth in developing countries shows a faster rate than the developed countries (graph 3.4).



Graph 3.4 Growth of world Population

Source - *http://www.sustainablescale.org/images/ 2015.07.20*

Activities

01. i. Name the two identifiable periods in the growth of world population.

ii. Explain clearly the factors that led to the differences in population growth during those two periods.

02. i. State what is meant by "Population explosion" explain the factors that affected the "population explosion" in developing countries.

ii. Study graph 3.4 and explain the differences between the population growth in developed and developing countries.

Distribution of World Population

How humans have spread geographically on the surface of the earth is known as population distribution. There are only a few regions on the earth which are physically congenial to human habitation. Due to the diversity in physical and human factors and unequal distribution is visible. Accordingly, there are densely populated regions and sparsely populated regions on the earth's surface.

Population that inhabits a certain unit of land is defined as population density. Generally it is shown as "number of people per square kilometre".

$$\text{Population density} = \frac{\text{Population}}{\text{Land area}}$$

Four densely populated regions can be identified

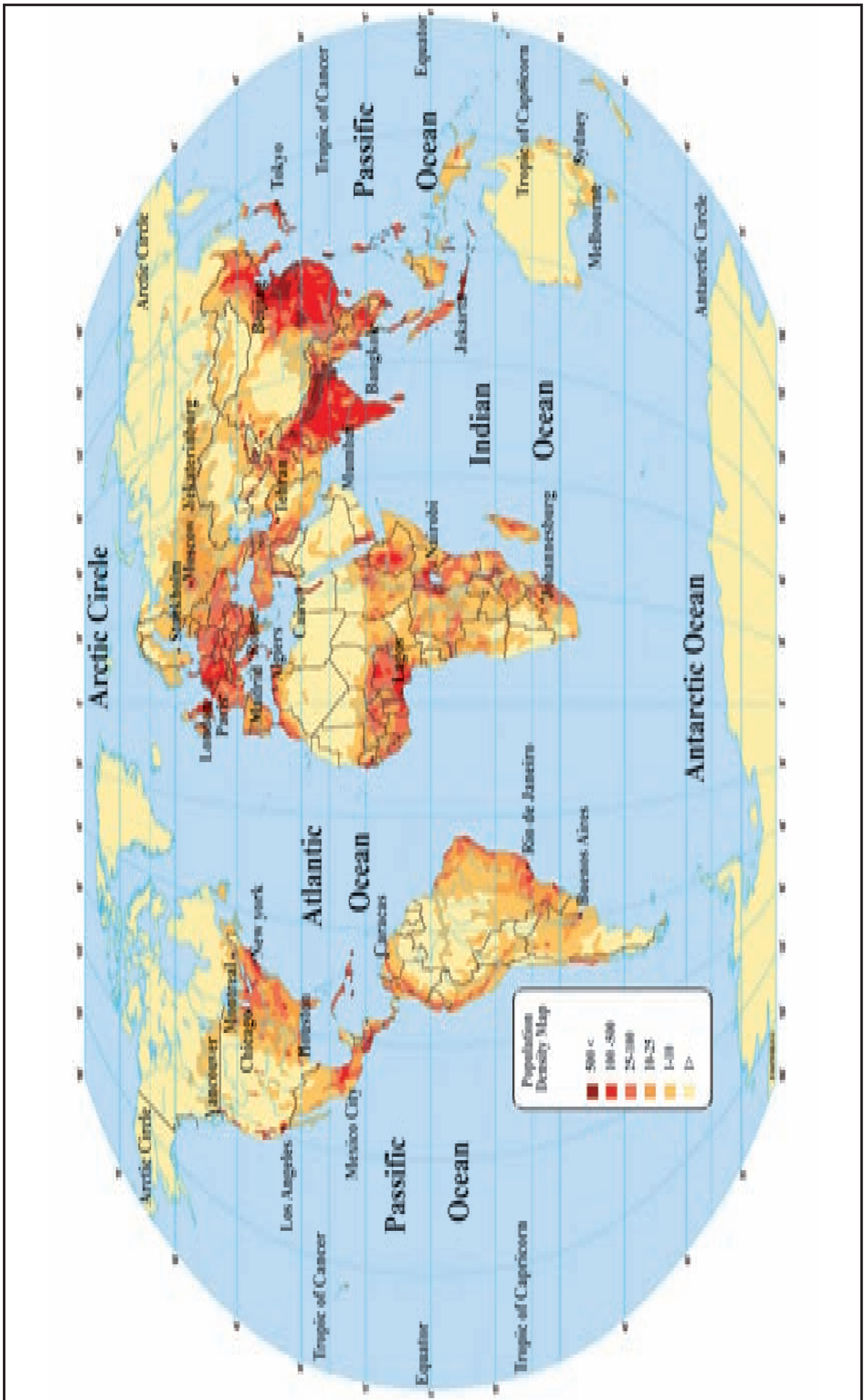
- East Asia
- South and South East Asia
- North West Europe
- North East Costal Zone of U.S.A

The North Eastern coastal zone of the U.S.A which is identified as a densely populated region has become a secondary concentration at world level at present.

All these population concentration, being found in coastal regions is a special feature. There are factors which contribute towards this feature of people crowding into these places. Physical surroundings congenial to human habitation, transport facilities and factors that are suitable for trade and other economic activities are some of those factors that have made people crowd to those places. A large number of million cities (cities that have a population over a million) are located within these zones.

It is only 10% of the land of the world that cover this population concentration but that 64% of the world population live within these concentrations is a special feature.

World Population distribution



Map 3.1- World Population distribution

Source : *http://education.randmcnally.com/images/World_Population.png 2014.12.10*

Secondary World population concentrations

In addition to these population concentrations, there are also many secondary population concentrations with a high density of population in almost all the countries.

- Eastern Western and North Eastern coastal concentration of North America (linked to the cities of New York, Sanfrancisco and Boston).
- The Eastern Coastal concentration of South America (linked to Rio de Janeiro in Brazil.
- Zone around the Nile Estuary (linked to the city of Cairo in Egypt).
- Concentration of Sierra Leone, Liberia, Ivory Cost and Ghana in Western Africa
- About 80% of the world population lives in the above mentioned densely populated areas They have a population density more than 65 persons per square kilometer.

Sparsely populated regions of the world

Out of the total land area of the world, 65% of the land area has a low population.

- Cold deserts (Antarctic and Arctic region)
- Hot deserts (Sahara in the African continent, and Central Australia).
- Mountainous regions (Himalayas, Andes; Rockies etc.)
- Tropical Rainforest Regions (Amazon, Congo)

In these regions the population density is less than five persons per square kilometer. Physical factors like rugged relief and climate has brought about this condition.

Except for the densely populates areas and the sparsely populated areas, the other areas of the world have an average distribution of people. In these regions the population density is between 5 - 65 persons per square kilometer.

Factors that contribute towards the unequal distribution of population

There are many factors that have contributed for the unequal distribution of population. These factors can be divided into two categories;

1. Physical factors
2. Human factors

Physical factors

The physical factors that affect population distribution are the following;

- Climate
- physical features
- Drainage

Variations in the climate on the earth have positively and negatively affected the population distribution in the world. Plains, river valleys and places with fertile soil with a tropical or a temperate climate have become areas with a high population. The Nile valley and the Indus valley are examples for such regions.

The land in the Polar Regions where the temperature is low, and the climate is extremely cold, the arid regions where there is a high temperature and a very low rainfall, and regions where there is a high temperature and heavy rainfall like the Amazon and the Congo Basins are areas of low population.

The nature of the terrain is also an important geographic feature determining population distribution. When the terrain consists of a rugged relief, the area is sparsely populated. For instance, in a mountainous region, population density is low. Areas around Himalayas, Andes and Rockies can be shown as examples. In addition to these, distribution of natural resources and natural vegetation are also factors that affect population distribution.

Human as well as physical factors have affected population distribution. Location of different industrial centers, urbanization, trade canters and ports, development of

infrastructure, availability of diverse services and establishment of administrative activities are also important human factors that affect population distribution.

The effects of the above factors are minimized with the development in scientific knowledge and technology.

Activities

1. Mark and name the main world population concentration zones and secondary concentration on an outline map of the world.
2. What factors have caused the unequal population distribution in the world? Describe with examples.
3. Name a million city each for the high density population conglomerates.
4. Prepare a list including problems related to high population concentration zones.

Assignment

Prepare a graph to show how the world population developed throughout history to date.

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Glossary

- Gender - පුම්තිරිබව - பாலின
- Literacy - සාක්ෂරතාව - எழுத்தறிவு
- Development process - සංවර්ධන ක්‍රියාවලිය - அபிவிருத்திச் செயன்முறை
- Optimum level - ප්‍රශස්ත මට්ටම - உத்தம மட்டம்
- Archaeological evidences - පුරාවිද්‍යාත්මක සාක්ෂි - தொல்லியல் சான்றுகள்
- Historical data - ඓතිහාසික දත්ත - வரலாற்றுத் தரவுகள்
- Population explosion - ජනසංඛ්‍යා ස්ඵෝටනය - குடித் தொகை வெடிப்பு
- Earth's surface - පෘථිවි තලය - புவி மேற்பரப்பு
- Population density - ජනඝනත්වය - குடித் தொகை அடர்த்தி
- Population concentration zones - ජන සංකේන්ද්‍රණ කලාප - குடித்தொகை கூட்டு வலயங்கள்
- Secondary concentration - ද්විතීයික සංකේන්ද්‍රණ - இரண்டாம் நிலைக் கூட்டு
- Sparsely populated regions - ජන හීන ප්‍රදේශ - குறைவான குடித்தொகைப் பிரதேசங்கள்
- Rugged relief - රළු විෂමතාව - கரடுமுரடான தரைத்தோற்றம்
- Diversity of climate - දේශගුණ විවිධත්වය - காலநிலைப் பல்வகைமை
- Arid regions - ශුෂ්ක ප්‍රදේශ - வரண்ட பிரதேசங்கள்
- Accessibility - සුගමතාව - சமமான தரையமைப்பு
- Location of industry - කර්මාන්ත ස්ථානගතවීම - கைத்தொழில் அமைவிடம்
- Urbanization - නාගරීකරණය - நகராக்கம்
- Infrastructure facilities - යටිතල පහසුකම් - உட் கட்டுமான வசதிகள்

4 The Population of Sri Lanka

Data regarding the population of Sri Lanka is collected by the Department of Census and Statistics after conducting a survey on population and housing. The first formal census was conducted in 1871 and generally, a census is carried out once in every ten years.

Although Sri Lanka is a developing country, when certain qualitative features like the Infant Mortality Rate, Maternal Mortality Rate, Life Expectancy and Literacy are considered, it shows features of a developed country. Therefore, when compared to the other developing countries, Sri Lanka remains at a special position. The progress in Education and Health sectors has greatly contributed to this situation.

The main objective of this lesson is to study about the population, the size of the population, the growth of population, the distribution of the population, the composition of population and the population structure.

Size of the Population

In 2012 the population of Sri Lanka was around 20.2 million. According to the census data, the density of Sri Lankan population is 323 persons per square kilometer.

When compared to other countries in the South Asian zone, Sri Lanka holds the 5th position in the size of population. However, a similar comparison shows that Sri Lanka has the lowest rate of population growth (observe table 4.1).

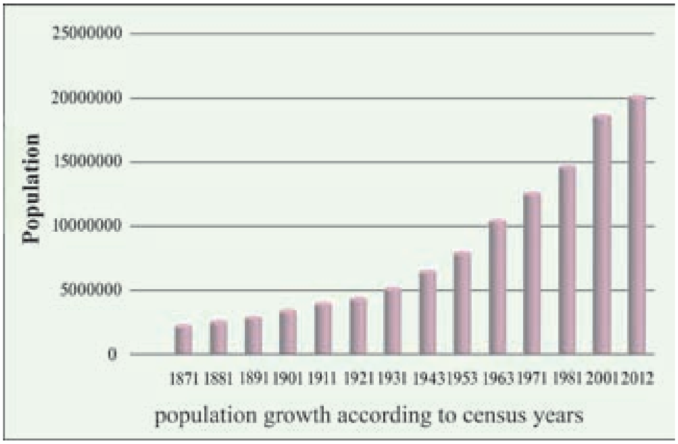
Table 4.1 - The Population, Population density and the Average Annual Growth of the population in South Asian countries (2013).

country	Population (millions)	Population density per km2	The general annual growth rate
India	1.252	381	1.3
Pakistan	182	229	1.8
Bangladesh	156	1087	1.1
Nepal	27	189	1.2
Sri Lanka	**21**	**324**	**0.8**
Bhutan	0.75	16	1.9
Maldives	0.34	1158	1.8

Source : *un Population chart, 2013, www.unpoulation.org*

Population Growth

Population growth is the growth of population within a specific unit of land. The census reports of Sri Lanka from 1871 show that there is a continuous growth in population. The population of Sri Lanka which was 2.4 million according to the first census in 1871 has risen up to 20.2 million in 2012. The continuous growth of population in Sri Lanka is depicted in graph 4.1. Table 4.2 shows the average annual growth rate, and the population growth during the inter-census period from 1871-2012.



Graph 4.1 - Population growth according to census years

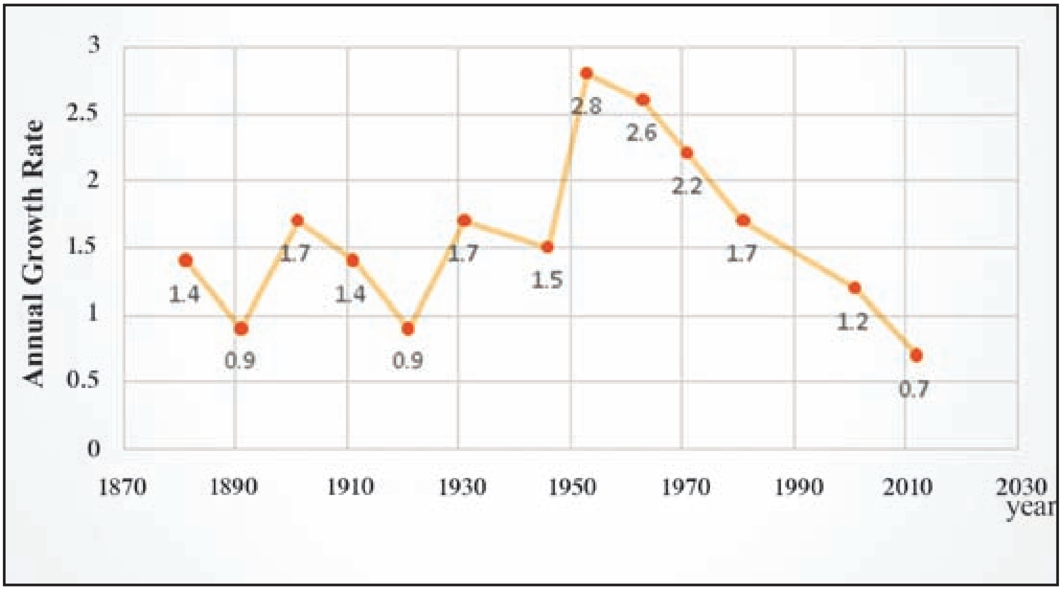
Source - *Population and housing data, Department of population and statistics 2012*

Table 4.2 population of Sri Lanka and the Average Annual Growth rate (1871 – 2012)

Census years	Population	The average annual year
1871	2,400,380	
1881	2,759,738	1.4
1891	3,007,739	0.9
1901	3,565,954	1.7
1911	4,106,350	1.4
1921	4,498,605	0.9
1931	5,306,871	1.7
1946	6,657,339	1.5
1953	8,097,895	2.8
1963	10,582,064	2.6
1971	12,689,895	2.2
1981	14,846,750	1.7
2001	18,797,257	1.2
2012	20,277,597	0.7

Source – *Population and housing census report 2012, based on department of population and statistics.*

Table 4.1 and graph 4.2 show that the rate of population growth has changed although the population has grown continuously since the first census. During the period from 1871 AD to 1946 AD, the population has grown at a slow pace, but the growth rate has accelerated after 1946. The highest rate of growth that is 2.8 was reported during the years 1946 – 53. The rate has gradually decreased to 0.7 in 2012. Decline in the natural growth and emigration cause the decline in population growth.



Graph 4.2 - The Ratio Differences In The Annual Population Growth Rate.
Source - *Population and housing data, Department of population and statistics 2012*

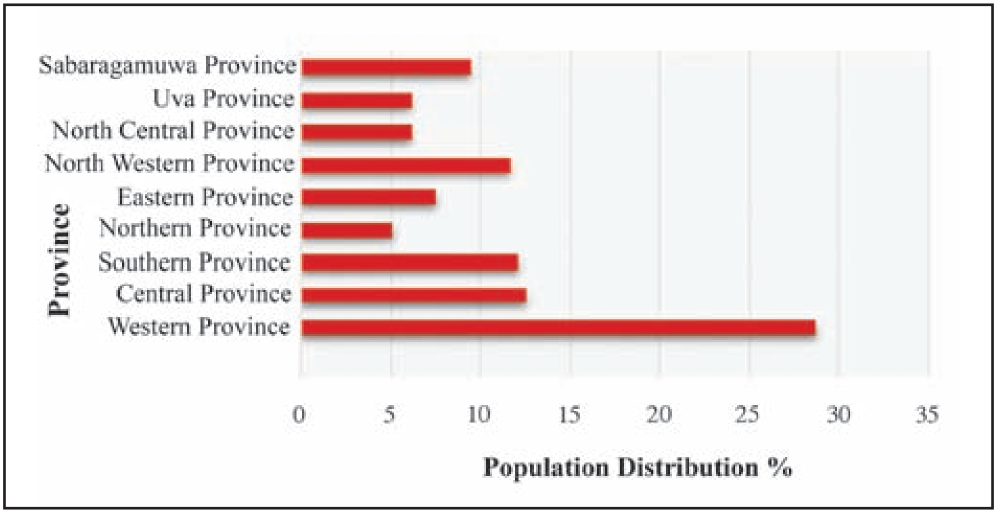
There are provincial differences related to population growth in Sri Lanka. The population growth in Sri Lanka is relatively higher in the districts of the Dry Zone than in the Wet Zone districts. Though the average growth rate of population in Sri Lanka is 0.7% the birth rate in Anuradhapura District is 1.33,in Hambanthota it is 1.17% and in the Monaragala District it is 1.15%.In the Wet Zone we can observe a lower rate of population growth. In Colombo it is 0.35%, in Nuwara Eliya it is 0.05% and in Badulla it is 0.39%. However, a higher population growth can be seen in Kaluthara and Gampaha districts in the Wet Zone, recording a rate of 1.23% and 1.02% respectively. According to the census reports, proximity to the Colombo district and migrations have affected the higher rates of population in these two districts.(http://www.statistics.gov.lk/17/06/2015)

Activity

1. prepare a bar-graph to show the size of population in the South Asian countries referring to the data given in table 4.1.
2. What are the temporal trends seen in population growth in Sri Lanka from 1871 to date?
3. Describe the provincial differences in population growth giving examples.

Population Distribution

The population distribution of Sri Lanka shows an unequal nature. When the population distribution in the provinces is considered, more than 1/4of the total population, around 28.8% of the population, is concentrated in the Western Province. A high population distribution is found in the Central Province (12.6%) Southern Province (12.2%) and in North Eastern Province (11.7%) too. The lowest population distribution, 5.2%, is found in the Northern province. (Graph 4.3)

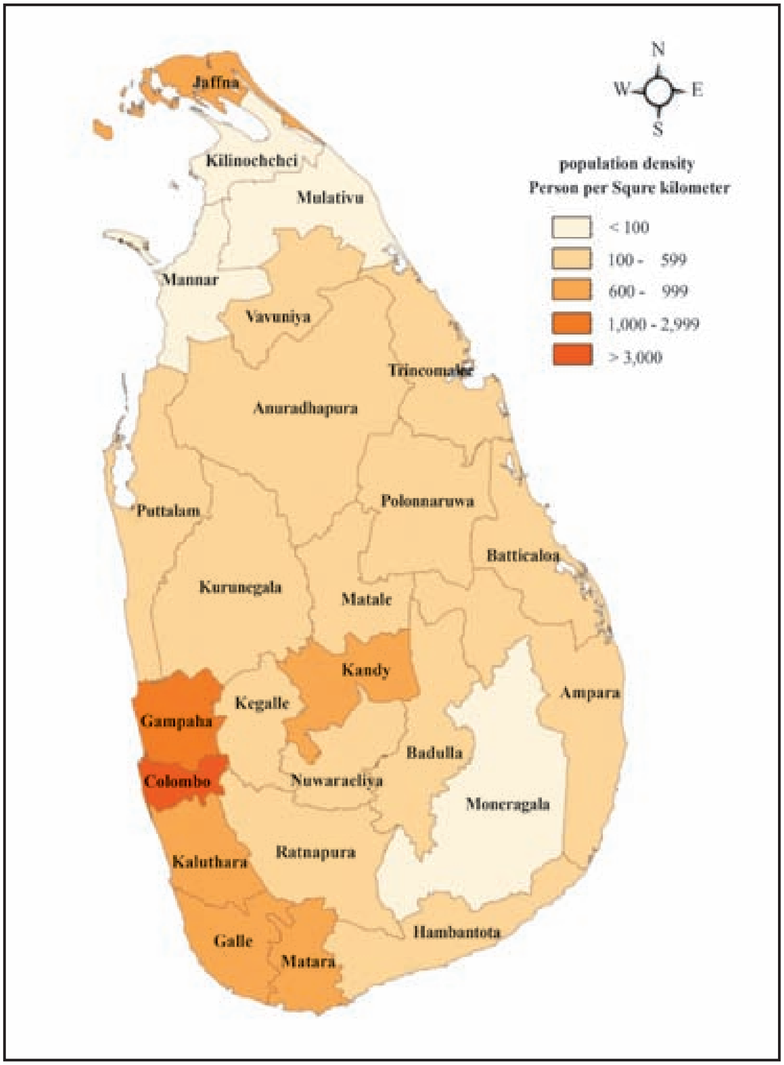


Graph 4.3- Population Distribution in the Provinces

Source – *Population and housing census data, Department of Population and Census 2012.*

The Colombo District has the highest population with a population of 2,323,826 according to the census conducted in 2012.

Many factors have affected the high population,such as accumulation of commercial and administrative operations, educational activities and services in this district. There is a very large population in the Gampaha District too (2,298,588). Migration to the Biyagama and Katunayake Free Trade Zones and selecting Gampaha as a convenient residential area due to easy access to Colombo are the main reasons for this relatively high population. Besides Colombo and Gampaha Districts, Kurunegala (1,611,407), Kandy (1,368,216), Kalutara (1,214,880), Rathnapura (1,082,299) and Galle (1,059,046) are the other districts with a high population. The population in these districts exceeds one million. Mullativu, Mannar, Killinochchi and Vauniya districts in the Northern Province record a very low population.



Map 4.1 - Population dencity in Sri Lanka

Source - *http://i.imgur.com/lfSi1.jpg 2015.07.20*

The Mulativu District has the lowest population which is 92,228.

The distribution of population can be clearly identified by the population density.

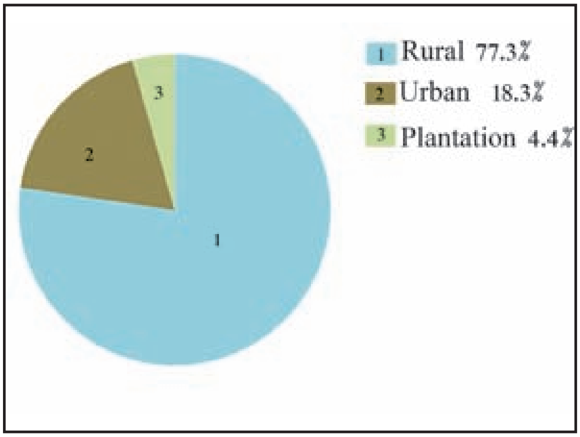
According to the census the average density of population is 323, but in certain districts there is high density of population while in certain other districts the population density is extremely low. Map 4.1 shows the population density of Sri Lanka in 2012.

Activities

1. Observe Map 4.1 and write down three districts which have the highest population and three districts which have the lowest population.
2. (i) On an outline map of Sri Lanka, shade the districts which contains the highest population and the lowest population.

   (ii) Explain clearly the reasons for the uneven distribution of population.
3. Mention three measures that could be taken to minimize the inequalities in the distribution of population in Sri Lanka.

The population distribution in Sri Lanka can also be classified as urban, rural and plantation population .According to the graph 4.4,the rural population is 77.3%, the urban population is 18.3% and the plantation population is 4.4%



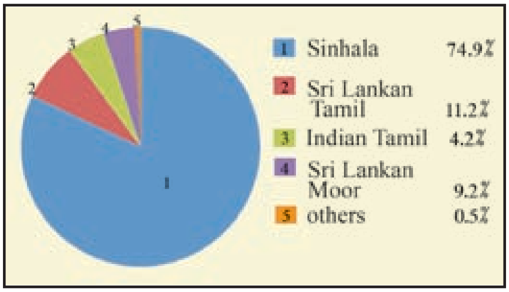
Graph 4.4 - Distribution of Population in Rural , Urban and Plantation areas

Source – *Population and housing data population and statistics department 2012*

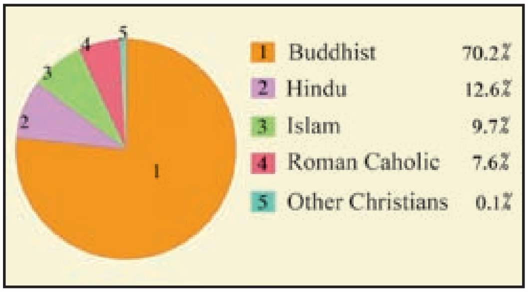
Population Composition

Sri Lanka is a multi-ethnic and multi-religious country. The population in Sri Lanka is divided into five categories; Sinhala, Sri Lankan Tamils, Indian Tamils, Moors and others. Malays, Burghers and Europeans represent others. The main religious communities are the Buddhist, Hindu, Islam and Christian communities. Graphs 4.5 and 4.6 depict the ethnic and religious composition in the population.

Even though different ethnic and religious communities represent the whole population, they all are Sri Lankans.



Graph 4.5. Ethnic Composition



Graph 4.6 Religious Composition in the population 2012

Source – *Socio Economic data of Sri Lanka 2013*

Population Structure

The **population structure** of a place shows how the **population** is divided up between males and females of different age groups. According to the 2012 census report age and gender structures are shown below.

Population according to age

< 15 yrs - 25.8%

Between 15 -59 - 62.0%

> 60 yrs - 12.2%

Population according to gender

Male - 48.5%

Female - 51.5%

Special features of the population in Sri Lanka

A special feature in the Sri Lankan population is the gradual decrease of young people and the gradual increase of the elderly people. **When the population of people over 59 years of age in a country or region rises due to increased life expectancy and declining birth rate it is called the population aging.** This results the gradual decline of the labour force. Sri Lanka, along with many other countries in the world is facing the challenge of population aging. In the same manner the percentage of women in the population has also increased.

By studying the age structure according to gender, we can find information regarding the labour force, the number of women who are capable to have children and the number of dependents.

Activities

1. According to the data of 2012 census , what special features of the Sri Lankan population can be identified?
2. “Like many other countries in the world, Sri Lanka is also facing the population aging problem”.

   Explain what is meant by the term ‘aging population’ and what are the problems a country would face relating to that?
3. Show by means of graphs the ethnic and religious composition of the population of Sri Lanka.

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Glossary

• Department of Census and Statistics	- ජන හා සංඛ්‍යා ලේඛන දෙපාර්තමේන්තුව	- தொகைமதிப்பு புள்ளிவிபரத் திணைக்களம்
• Developing countries	- සංවර්ධනය වෙමින් පවතින රටවල්	- அபிவிருத்தி அடைந்து வரும் நாடுகள்
• Infant mortality	- ළදරු මරණ	- சிசு மரணம்
• Maternal mortality	- මාතෘ මරණ	- கற்பிணித்தாய் மரண வீதம்
• Life expectancy	- ආයු අපේක්ෂාව	- பிரசவ மரணம்
• Population composition	- ජන සංයුතිය	- சனத்தொகை கூட்டு
• Population structure	- ජනසංඛ්‍යා ව්‍යුහය	- சனத்தொகைக் கட்டமைப்பு

- Census reports - සංගණන වාර්තා - தொகை மதிப்பு அறிக்கை
- Annual growth rate - වාර්ෂික වර්ධන අනුපාතිකය - வருடாந்த வளர்ச்சி வீதம்
- Growth rate - වර්ධන ශීඝ්‍රතාව - வளர்ச்சி வீதம்
- Birth rate - උපත් අනුපාතිකය - பிறப்பு விகிதம்
- Death rate - මරණ අනුපාතිකය - இறப்பு விகிதம்
- Natural growth - ස්වාභාවික වර්ධනය - இயற்கை அதிகரிப்பு
- Labour force - ශ්‍රම බලකාය - ஊழியப் படை
- Dependents - යැපෙන්නන් - தங்கியிருப்போர்

5 Development

Development is a dynamic concept. It is continuous and unending.

The main objective of this chapter is to study the basic concepts of development and also the development procedures in Sri Lanka.

The concept of development has changed over time. Until the middle of the 20th century, the economic development in a country was termed as 'development'. (Fig. 5.1)

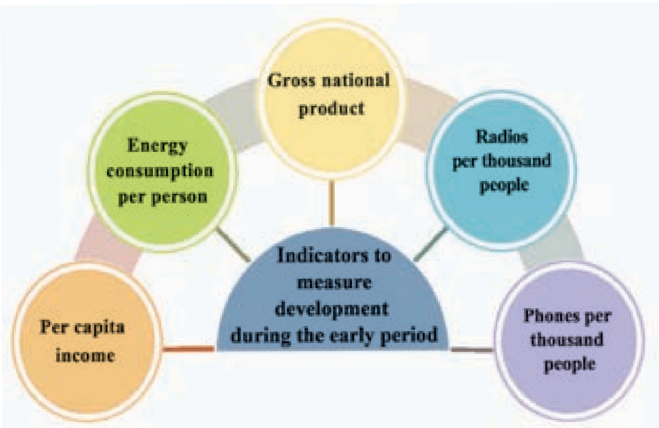


Fig. 5.1 - Indicators used to measure development during the early period.

Later, "development" became a broader concept which encompasses several fields. By the end of the 20th century, development was not only an economic and physical assessment but also included components essential for human development.

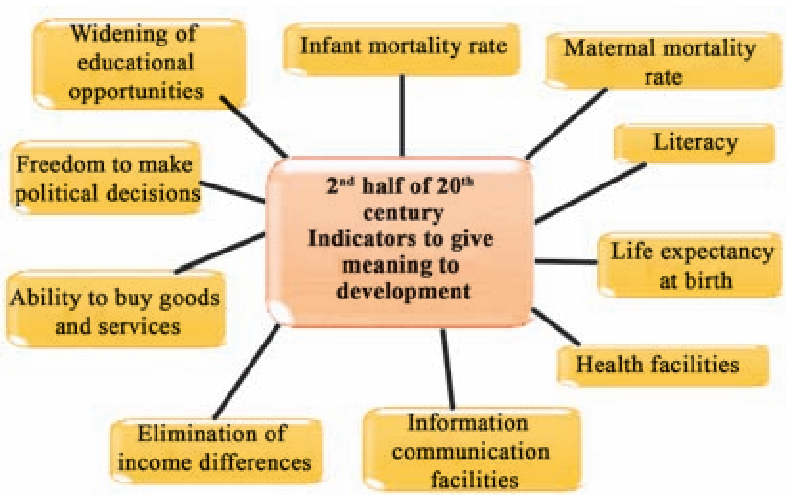


Fig. 5.2 - present Indicators to measure development.

The meaning of the term "development" becomes clearer when some definitions of development are studied.

"Social development should take place along with economic development. social development should take place within sectors encompassing food and nutrition, health, education, housing social security, clothing, leisure and human freedom" (1978, UNESCO Declaration).

"Development is a chain of processes which includes factors related to population, social, cultural and ethical issues"(3rd development decade 1980 – 90 UNO).

In the process of development focus was on protecting and conserving the environment, and also on the quality of the environment in the 80's and in the 90's more focus was on sustainable development. With regard to sustainable development, the inter-relationship among the economic, social and environmental fields was also incorporated into the concept of development. As the concept of development has evolved over time, different indicators to measure development have also been used.

Activities

1. Prepare a simple definition to make the concept of 'development' more meaningful.
2. Obtain instructions from teachers and collect other definitions to identify the concept of 'development'.

3. Indictors to measure Development

Although development has been identified as a concept, different countries adopted different indicators to measure it. Once the wide meaning of development was understood, various institutions,organizations and individuals introduced more qualitative indicators to assess it.

Indicators to measure Development

Old indicator

- Gross National Product
- Per capita income
- Gross Nation Development

Modern indicator

- Physical Quality of Life Index(P Q L I)
- Human Development Index (H D I)
- Human Poverty Index (H P I)
- Human Suffering Index (H S I)

It was not possible to express the real status of 'development' by the indicators used during the early period. They were adequate only to show the middle and low levels of development. Later the concept developed further, and the Human Development Index (HDI) which was introduced by the United

Nations Development Programme (1990/1999), was used to measure 'development'. Through that indicator, it was possible to avoid the weakness and identify the 'real status of development'. This indicator which includes three basic features of human development is a compact indicator. The main indicators used in measuring Human Development Indicator are, life expectancy at birth, literacy and purchasing power parity tallied with the per capita gross national product.

According to the index which extends 0-1 countries of the world can be identified under four groups.

1. Countries where human development is very high
2. Countries where human development is high
3. Countries where human development is moderate
4. Countries where human development is low

Sri Lanka, in the year 2012 has obtained development index with a value of 0.715 and had acquired the 92nd place out of 187 countries of the world.(Central Bank Report of Sri Lanka 2012)

Among the SAARC countries, Sri Lanka has the highest level of human development and is also the only SAARC country which is in the high development group (Annual Report 2013. Finance and Plan implementation Ministry)

Activity

1. Write two indicators used to measure development in the,
   (a) Early period.
   (b) Modern period.
2. "Development does not mean only the economic development of a country" Explain this statement with examples.
3. "The best indicator to measure the development of a country is the Human Development Index" Give reasons to justify this statement.
4. Describe briefly how the development of a country can be done without being an obstacle to environment equilibrium.

Sustainable Development

In the past most countries of the world considered progress in the economic field as development. This idea being prevalent even during the 21st century has given rise to several unfavourable consequences.

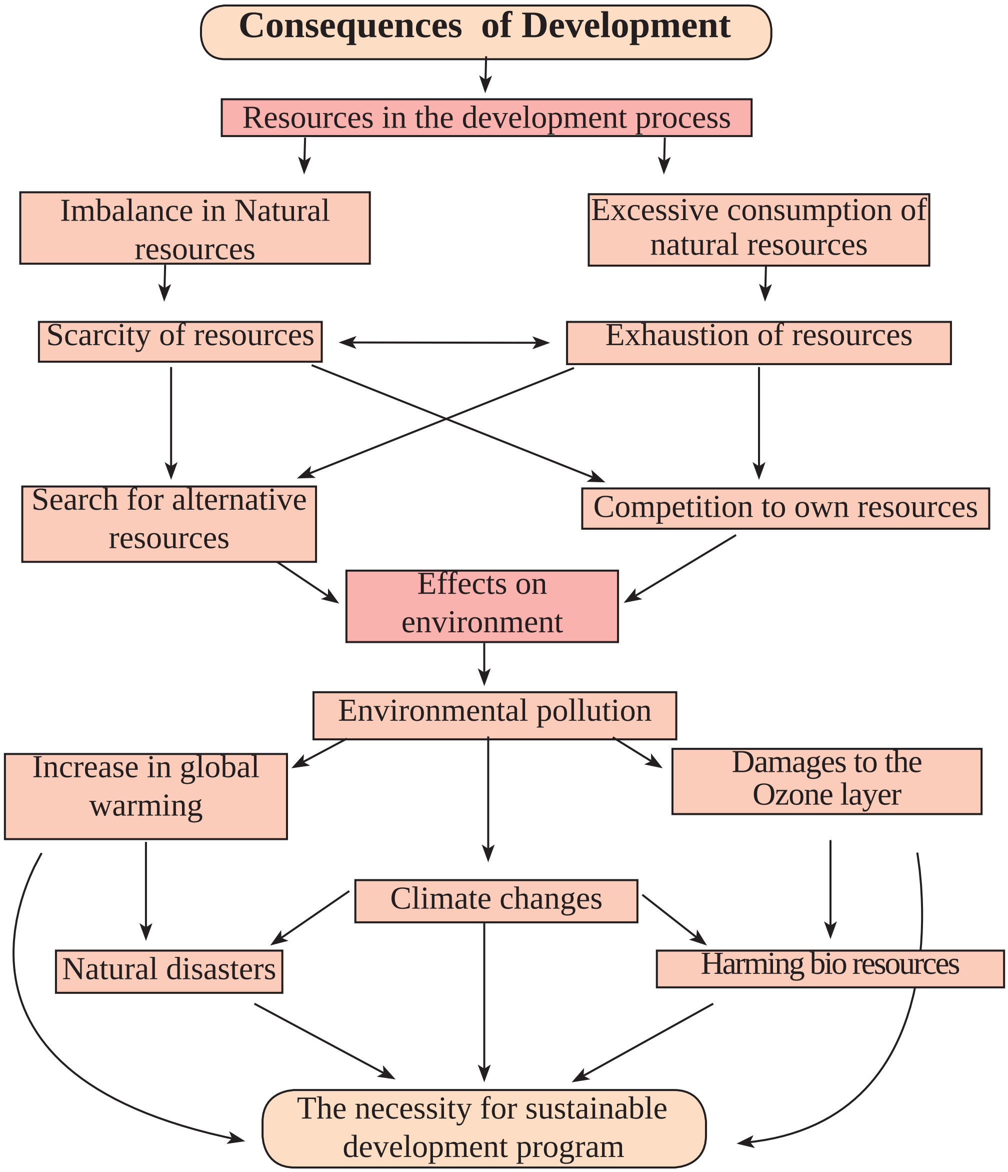


Fig. 5.3 - Development Reactions

Due to the fast growth of population, increase in needs and needs becoming more complexed new production process has been widened. As industrialization took place without proper control, an environmental imbalance emerged. Hence attention was paid on sustainable development to prevent the imbalance of the environment. The objective of sustainable development is to incorporate the management of the development process with the environmental management. It focuses on future while upgrading the man's existence and life style.

Activity

Explain with examples that it is essential to have a sustainable development process for the survival of a country.

Assignment

1. With the aid of the information of mass media, Prepare a list of problems which have emerged when countries of the world undergo the development process.
2. Present suggestions to solve those problems.

Recent development activities in Sri Lanka

A self - sufficient economy was prevalent in Sri Lanka during the hydraulic civilization. However, when Sri Lanka became a colony of western nations, it turned out to be an import - export economy. After Sri Lanka gained independence, farming settlements, river – valley developments, multi- purpose development schemes, Large scale industries free trade zones, export villages, industrial settlements and activities of similar nature took place along diverse fields.

The main focus of the present development process is on the improvement of infrastructure facilities. Improvement of infrastructure facilities which is considered as a necessity for the development of a country, would also help in the human resource development.

By improving infra- structure facilities

- New areas of the country will be open to development
- Widening of the trade market
- New products reach the market quickly
- Movement of passengers and goods is accelerated
- Time is saved and physical distance become less
- Internal migration patterns change
- New employment opportunities arise
- A change occurs in the supply route grid of existing goods and services (Automobile, Aviation, Harbour)

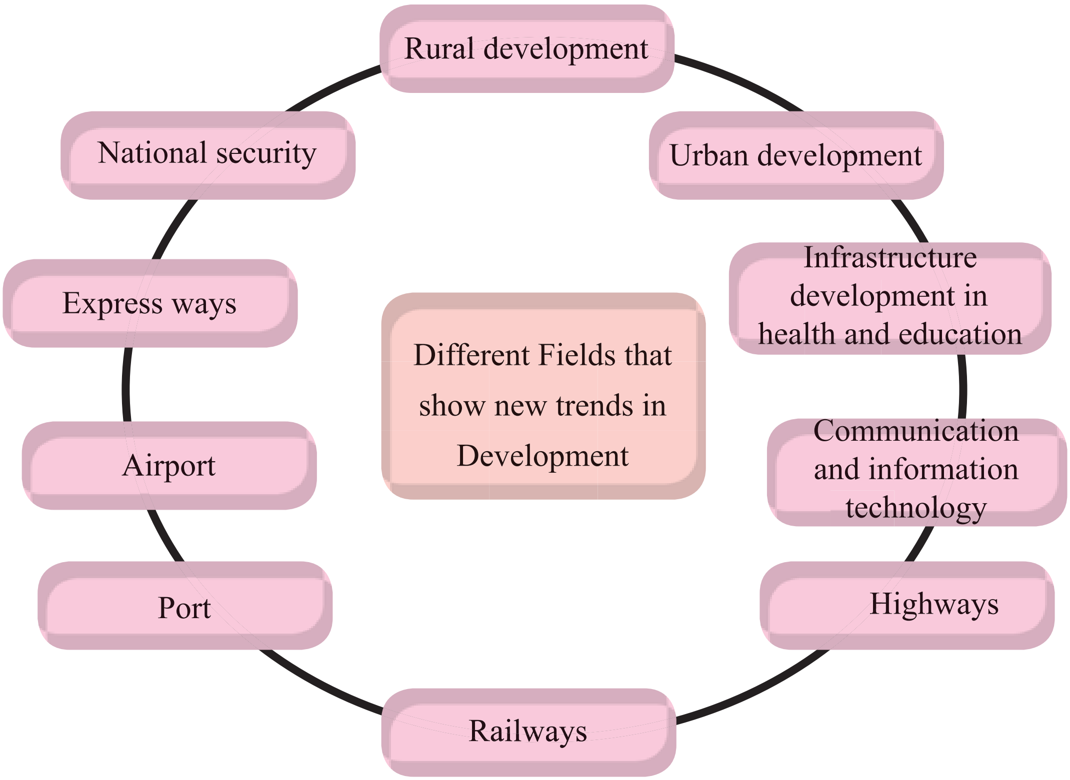


Fig. 5.4 - Recent development projects in Sri Lanka

Railway and highway development



Fig: 5.5 - Highway bypass

- Construction of many new roads (Colombo – Matara, Colombo -Katunayaka Colombo outer circular Road)
- Proposed Express ways ((Colombo – Jaffna, Colombo – Kandy, Matara- Hambantota)
- Road construction project in the North; under this project construction has been completed on the Kandy Jaffna road, Paranthan Pooneryn, Mankulam –Wellamkulam, BatticaloaTrincomalee and many other roads.
- As buses with modern facilities run on these roads, time spent on travelling and physical distance have been minimized.
- Widening and carpeting of existing roads.

- Minimizing traffic congestion by constructing flyovers.(Nugegoda, Ragama, Veyangoda).
- constructing underground tunnels (Ramboda) and pedestrian crossings(Kandy, Borella).
- Removal of unauthorized constructions on pavements and construction of pavements(Colombo Fort ,Pettah and Kandy).
- Improving the Southern railway.
- Widening the Kelani valley road.
- Reconstructing the Northern Railway.
- Commencing work on the proposed- Matara – Kataragama railway up to Dikwella.
- Reconstructing Colombo – Jaffna Railway.

Activities

1. Mark the existing and proposed expressways on an outline map of Sri Lanka.
2. What are the advantages of developing roads and railways in a country?

Development of Ports and Airports

- Developing the Bandaranayake International Airport in Katunayake with modern facilities.
- Constructing a new international airport at Mattala.
- Developing domestic airports like Rathmalana, Palaly and Anuradhapura.
- Improving infrastructure facilities such as railways, availability of motor vehicles around airports.
- Making Katunayaka and Mattala airports as centers providing service for the international air services during emergencies.
- Improving Colombo Sothern port, Oluvil port and widening their service conditions.



Fig. 5.6 - Colombo Harbour (with the new jetty)

- The construction of Magampura Port in Hambantota with modern facilities. Arrangement for re-export, providing of fuel and water for ships storage for fuel, vehical yards and container terminals are also planned to be built in the surroundings.



Fig. 5.7 - A container ship

- It is planned to build the Port city, with Housing complexes, Shopping Complexes, Hotel complexes, Service centers, and places with facilities for recreational activities.
- Identifying the location of Sri Lanka at the centre of the maritime silk route and making it the center of re-export in the container transport.
- Improve Dry Docks.
- Improve facilities in old ports located in the North, East and Galle. If the above plans are implemented, Sri Lanka would be a destination for large ships and for tourist cruise ships with very modern facilities.

Development of Human Resources

In developing a country, man is considered the most important resource. He has been able to innovate and produce goods using all the resources of the physical environment by using his intelligence and skills. In other words, man creates the cultural environment based on the physical environment. Hence it becomes essential to launch programme to improve man's physical and mental skills as well as his spiritual values when developing human resources.

Since ancient times, Sri Lanka has been a country favorable to man. From the time Sri Lanka obtained independence, education, health services and security was provided free. Certain services are provided with concessions to a selected crowd. Sri Lanka is also considered a welfare state because all governments that came into power provided common amenities free of charge.

Housing projects, community health programmes, Devineguma, Samudhi and Jana Saviya programmes were launched from time to time for human development. Maga Neguma project to develop roads at rural level and self employment projects were started to bring about development in the community. Under these projects opportunities to bring about leisure and entertainment were also provided.

Similar to improvements in various fields in the country there are innumerable projects which are also implemented at rural, urban and provincial levels.



Fig. 5.8 - Diyawanna park

It is essential to develop education of the citizens in order to improve their ability to develop the country. With the aim of realizing this objective, special attention paid to provide education for all, improve quality of education and organize educational opportunities to suit the changing labour market. Many steps have been taken with these purposes in view.

Educational development progress

- Giving scholarships to students
- Providing modern laboratory facilities
- Navodaya schools
- Technical schools
- Poly- Technical Colleges.
- Setting up vocational training institutes for school dropouts
- Increasing the number of universities and increasing the student intake
- Introducing technological subjects to G.C.E. (Advanced Level)
- Thousand schools programme
- Widening of higher education
- Science colleges
- Computer training institutions

Fig. 5.9 - Steps taken to develop Education in Sri Lanka

In the Development Process of a country, it is essential to produce a healthy community. For this purpose health facilities of a country has to be developed. The services rendered by the Health Sector as a welfare service in Sri Lanka has to be appreciated.

Progress in the health sector

- Improving facilities in rural hospitals
- Sending more doctors for overseas specialist training
- Increasing the number of hospital staff
- Introducing programmes to prevent diseases
- Improving Child and maternity clinics, clinics for elderly people and developing their facilities
- Obtaining modern equipment for surgeries and diagnosis
- Implement community based programmes to promote health
- Promote Ayurvedic Medicine
- Expanding mobile clinics conducted in schools, public associations and other institutes
- Act on the concept of providing clean drinking water for all
- Intervene to prevent public activities that are unfavourable for health
- Implementing public awareness about good health habits

These services are programmes focused on human development in Sri Lanka within the past decade. People with healthy bodies and healthy minds can successfully achieve benefits of education and it is easy to motivate them towards the development process. Similarly, they can change, bear the burden of change and also succeed in enjoying its benefits. It is expected to build a social environment through such a group of citizens by developing health and education sectors.

Activities

1. Write down five procedures that have been implemented to develop human resources in Sri Lanka.
2. Explain how such procedures contribute towards the development of the country with examples.

Regional Development

To facilitate provincial development administrative divisions are set up in Sri Lanka, as villages, Gramaseveka Divisions, Divisional secretariat Divisions, Districts and Provinces. Similarly, from the National Level to the Provincial level there is a chain of activities in the development process.

The main objective of Regional Development is to act towards human welfare, minimizing discriminations, by utilizing the resources and the physical environment centered in different areas.

Since gaining independence, for many decades, various development projects have been implemented in order to minimize the gap between the village and town. (table 5.1)

Table 5.1 - Various development projects in Sri Lanka.

Village	Town
• Empowering the low income groups in the rural sector by means of Janasaviya, Divineguma and Samurdhi projects. • Taking steps to remove rural unemployment by the 200 garment Factory project. • Reconstruction of rural roads by using asphalt carpeting and also paving them with concrete and stone. • Improvements in common amenities under "One task for one village"programme. • Empowering the economic Strength of rural unemployed under the Divineguma project. • Improving rural industries and setting up rural hydro-power projects to uplift the lives of people in remote, isolated villages. • Implementing community based water projects for cultivation of crops and to fulfill water requirements. • Implementing Gami Diriya project Centered on places of worship, Sports associations and funeral welfare societies. • Appointing service personnel who would work with rural family units and set up programmes to empower such families.	• Broadening roads in urban areas by the road Development Authority. • Removal of unauthorized constructions and clearing pavements for the pedestrians. • Landscaping and developing cities (Colombo, Sri Jayawardenepura Kotte, Gall and Kandy). • Widening opportunities for leisure and entertainment in urban surrounding. • Removal of slums, accelerating high rise building projects, new housing complexes and reconstructing urban housing complexes by National housing Development authority. • Building new shopping complexes. • Removal of swamps in urban areas and constructing Sports grounds, swimming pools, and leisure parks on such lands. • Improving facilities close to public utility centers. • Constructing urban car parks. • Changes made in Provincial Administration structure; Provincial Councils Pradeshiya Sabha Municipal councils Urban councils. • Implement solid waste management programmes.

Activities

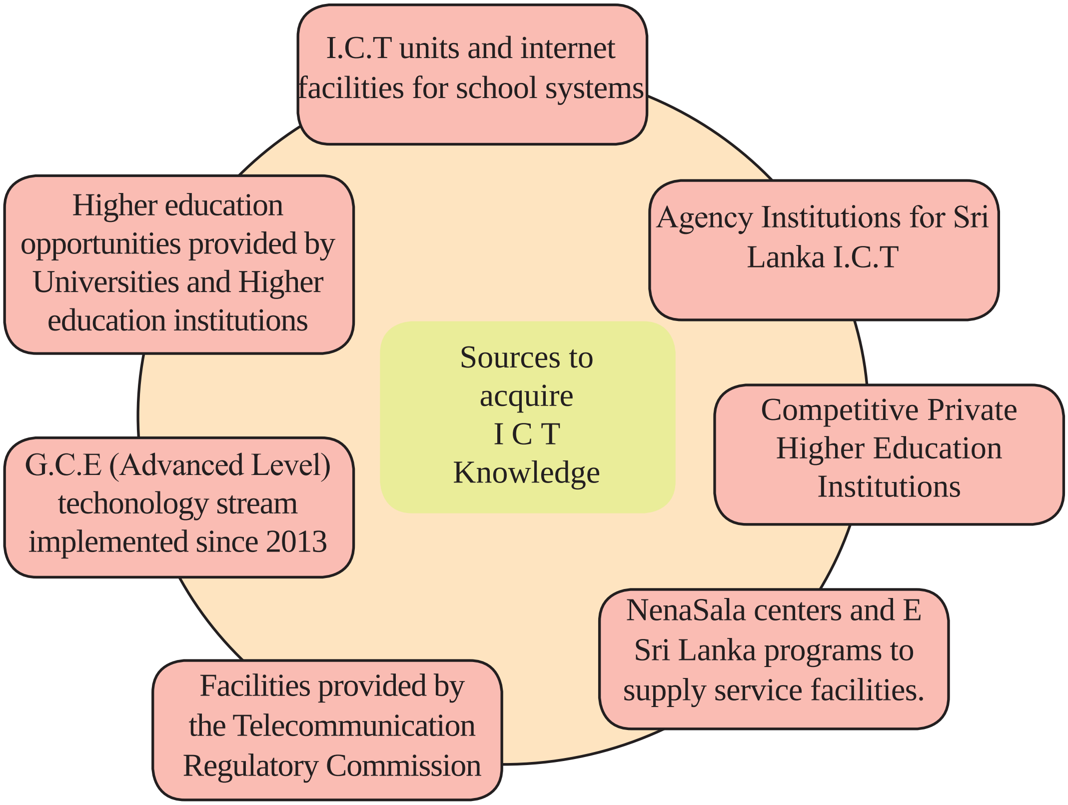
1. Name three benefits that can be achieved by improving facilities in rural areas.
2. "Development in village / town helps development in the country" Explain this statement with examples.

Knowledge based Development and Information and Communication Technology

Information and communication technology is a service which is used to collect, store, analyze and exchange data in various sectors. Through this the country and the human society has gained many facilities.

- Improvement in relationships within and outside the country.
- Opening up more avenues in education.
- Opening up direct and indirect employment opportunities and assisting both the prospective service providers and the services receivers.
- widens the knowledge of ordinary people and also broadens opportunities to fulfill employment needs.
- Could contribute quickly in times of disaster (like during cyclones, floods, land slides and tsunamis).
- With electronic financial system transactions become quick and safe.

It is important that a person must be aware of how he could obtain the service facilities of Information and communication technology and also about the equipment and tools to be selected for such activities. It is essential for a person to have a basic education and to know many steps as to how technological tools can be manipulated, collect data, store and analyze them and to communicate. In Sri Lanka new avenues have been opened up for diverse professions and for those engaged in education through Information and Communication Technology.



Activities

1. Prepare a paper including recent trends in the development activities in Sri Lanka.
2. Describe how upgrading infrastructure in a country affects development .
3. Prepare a list to show the benefits that a country can gain by improving I.C. T.
4. Write down three advantages and three disadvantages of the internet.

Assignments

Prepare a field work book including information about a programme implemented to improve facilities in the urban or rural areas in the region where you live.

Bibliography and Sources

Ministry of Finace and Planning /Annual Report 2013

Glossary

Static concept	- ගතික සංකල්පය	- நிலையான எண்ணக் கரு
Real national product	- මූර්ත දළ ජාතික නිෂ්පාදිතය	- மொத்தத் தேசிய உற்பத்தி
Gross national per-capita product	- ප්‍රතිශීර්ෂ දළ ජාතික නිෂ්පාදිතය	- மொத்தத் தேசிய தனிநபர் உற்பத்தி
Growth rate of G.N.P.	- දළ ජාතික නිෂ්පාදිතයේ වර්ධන වේගය	- G.N.P. இன் வளர்ச்சி வீதம்
Physical Quality of Life Index	- භෞතික ජීවන තත්ත්ව දර්ශකය	- பௌதிக வாழ்க்கைப் பண்புச் சுட்டெண்
Human Development Index	- මානුෂ සංවර්ධන දර්ශකය	- மனித அபிவிருத்திச் சுட்டெண்
Human Poverty Index	- මානුෂ දරිද්‍රතා දර්ශකය	- மனித வறுமைச் சுட்டெண்
Human suffering Index	- මානුෂ පීඩක දර්ශකය	- மானிட ஊகச் சுட்டெண்
Composite Index	- සංගෘහිත දර්ශකය	- கூட்டுச் சுட்டெண்
Life expectancy	- ආයු අපේක්ෂාව	- ஆயுள் எதிர்பார்ப்பு
Literacy	- සාක්ෂරතාව	- எழுத்தறிவு
Purchasing power parity	- ක්‍රය ශක්තිය	- கொள்ளளவு சக்தி
Sustainable development	- තිරසර සංවර්ධනය	- நிலைத்திருக்கும் அபிவிருத்தி
Industrialization	- කාර්මීකරණය	- கைத்தொழில் மயமாதல்
Environmental disequilibrium	- පාරිසරික විසංතුලනය	- சூழல் சமநிலையின்மை
Environmental equilibrium	- පාරිසරික සමතුලිතතාව	- சூழல் சமநிலை
Hydraulic civilization	- ජලාශ්‍රිත ශිෂ්ටාචාරය	- நீர்வள நாகரிகம்
Self-sufficient economy	- ස්වයංපෝෂිත ආර්ථිකය	- தன்னிறைவுப் பொருளாதாரம்
Agricultural Colonies	- ගොවි ජනපද	- விவசாயக் காலனிகள்

• Export villages	- අපනයන ගම්මාන	- ஏற்றுமதிக் கிராமங்கள்
• River Valley Development Project	- ගංගා නිම්න සංවර්ධන ව්‍යාපෘතිය	- ஆற்றுப் பள்ளத்தாக்கு அபிவிருத்திச் செயற்றிட்டம்
• Multi- Purpose Development Projects	- බහුකාර්ය සංවර්ධන යෝජනා ක්‍රම	- பல்நோக்கு அபிவிருத்திச் செயற்றிட்டம்
• Free – trade zones	- නිදහස් වෙළෙඳ කලාප	- சுதந்திர வர்த்தக வலயம்
• Industrial colony	- කාර්මික ජනපද	- கைத்தொழில் காலனி
• Movement of goods	- භාණ්ඩ සංචලනය	- பண்டங்களின் அசைவு
• Internal migrations	- අභ්‍යන්තර සංක්‍රමණ	- உள்நாட்டு இடப் பெயர்வு
• Underground tunnels	- භූගත උමං මාර්ග	- சுருங்கப் பாதைகள்
• Pedestrian crossings	- පදික මාරු	- பாதசாரிகள் கடவை
• Unauthorized constructions	- අනවසර ඉදිකිරීම්	- சட்டவிரோதக் கட்டமைப்புகள்
• Re-exports	- ප්‍රතිඅපනයන	- மீள் ஏற்றுமதி
• Vehicle parks	- වාහන අංගන	- வாகன நிறுத்துமிடம்
• Container transport	- බහාලුම් ප්‍රවාහන	- கொள்கலன் போக்குவரத்து
• Re-export centre	- ප්‍රතිඅපනයන මධ්‍යස්ථානය	- களஞ்சிய நிலையம்
• Curative programmes	- රෝග නිවාරණ වැඩසටහන්	- நோய் பரிகார நிகழ்ச்சித் திட்டம்
• Road Development Authority	- මාර්ග සංවර්ධන අධිකාරිය	- வீதி அபிவிருத்தி அதிகார சபை

6 Natural hazards in the world

The natural environment in the world is subjected to large or small scale natural changes periodically. These changes occur without much notice at times. Certain changes are quite fascinating. Sometimes they occur unexpectedly and could be quite destructive. In whichever way they occur, the natural environment has been subjected to changes since the beginning of the earth. These changes may continue to occur in future too. Some of these changes occur without human influence and there are some instances where these changes are intensified as result of human activities. In whatever the way they occur, the possibility to cause damage to environment is identified as a natural hazard.

The objective of this chapter is to discuss the areas where natural hazards occur in the world and the problems they cause.

Natural Hazard

A natural hazard is an event in the environment that occurs naturally that could cause harm to humans, economic assets or environment.



Fig. 6.1 - Hazard

Natural Disaster

If the community and their physical resources and the human activities are damaged by effects of a certain hazard, such incidents are called natural disasters. In other words, a natural disaster occurs when natural hazards are activated. War, terrorism collapsing of buildings, road traffic accidents that affect the community are known as disasters but they are not considered as natural disasters.



Fig. 6.2 - Natural disaster



Fig. 6.3 - A few natural disasters

The hazards can be categorized on the basis of their origin on earth.

Type of Hazard	Examples
• Geological hazards (With a geological origin)	Earthquakes, Tsunami, Volcanoes, Landslides.
• Climatic hazards (With a climatic origin)	Cyclones, Lightning, Floods, Drought, Bush fire.
• Biological hazards (With a biological origin)	Epidemics,Bush fire, Extinction of flora or fauna on a large scale.

In addition to this categorization, earthquakes, volcanic eruptions, tsunamis, cyclones and lightning can be identified as natural hazards that occur without any human influence while landslides, droughts, floods, bushfires and avalanches can be identified as natural hazards that are intensified by the human activities.

Activities

1. Identify what a hazard is.
2. Explain the difference between a natural hazard and a disaster with examples.
3. Classify the following natural disasters that occur due to natural processes and that are intensified due to human activities.

   (floods, tsunamis, cyclones, bushfires, avalanches, earthquakes, droughts and landslides).

Earthquakes

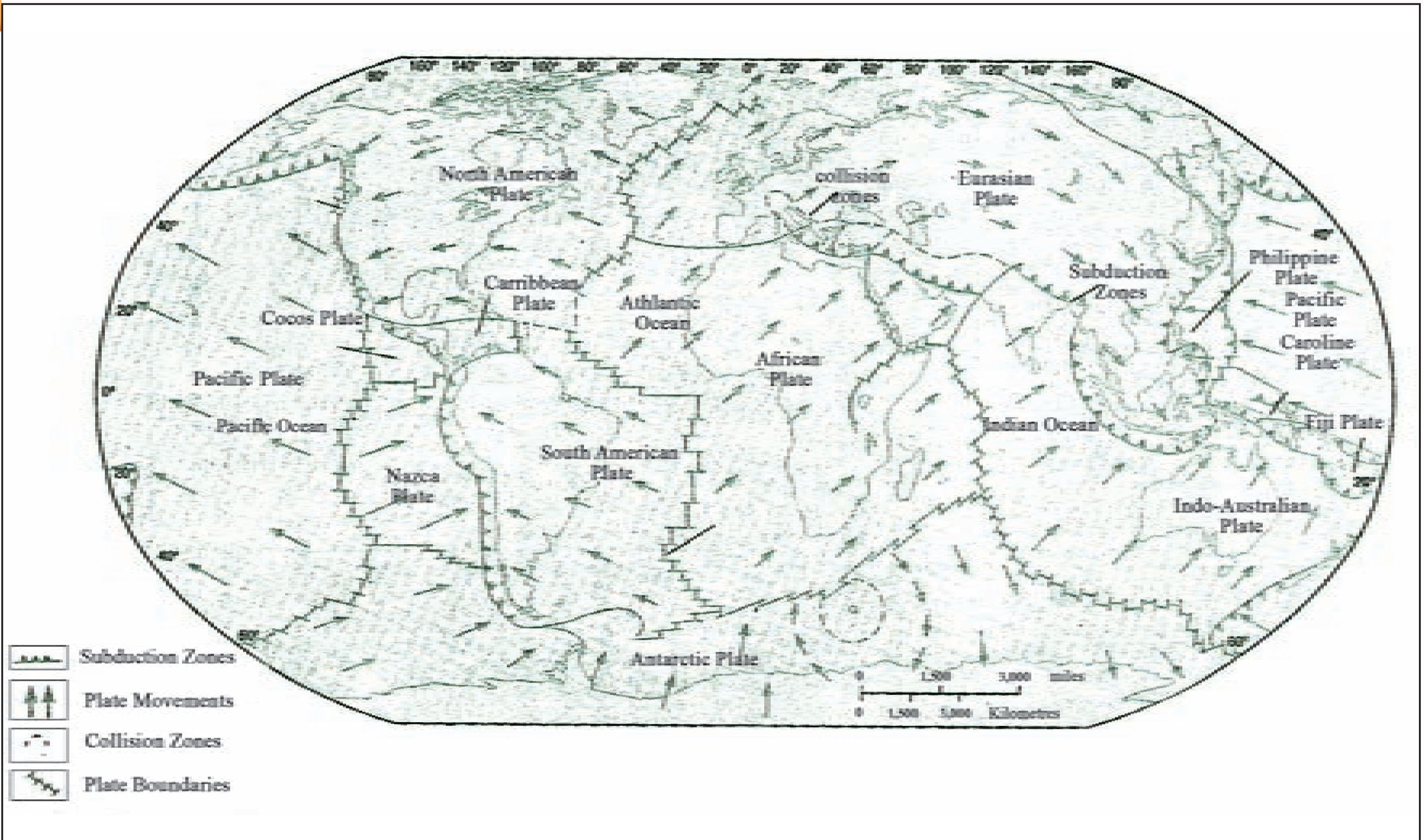
Tremors occur on the surface of the Earth as a result of the shock waves generated by the movement of rock masses within the crust of the Earth particularly near boundaries of tectonic plates. When they occur suddenly and bring about a vast destruction, they are called earthquakes.



Fig. 6.4 – An incident of an earthquake

Causes for Earthquakes

The sudden release of the stored energy in the Earth's crust, when it exceeds the capacity, it causes Earthquakes. The earth's crust is made up of many tectonic plates which are connected to each other. There are seven main plates and a number of minor plates (Map 6.1). These tectonic plates drift towards different directions and earthquakes are caused as they collide with each other causing powerful movements at the margins. Earthquakes also occur due to faults that are created on the earth's surface or during volcanic activity.



Map 6.1 - How tectonic plates in the world are formed

Magnitude of earthquakes

A seismometer is used to measure the intensity or the magnitude of the earthquakes. The seismic information received through that is recorded in the seismograph. The values indicated can be included in a scale. This method was introduced by Charles F Richter in 1935. Hence, it is called the Richter scale.

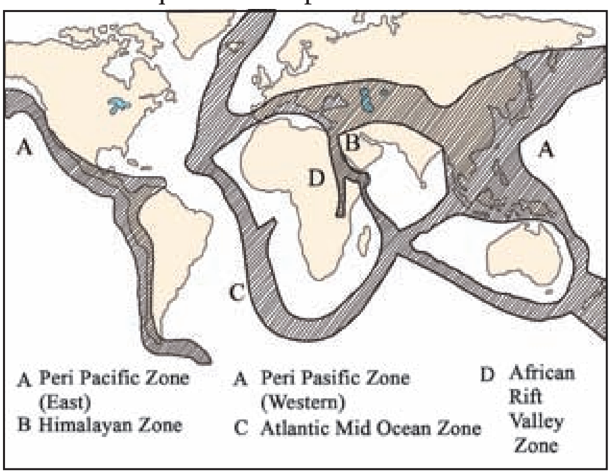
Table 6.1 indicates the magnitude of earthquakes and the results according to the values on the Richter scale.

Table 6.1 - Magnitude of earthquakes and their impacts

Value of the Richter scale	Result
2.0 - 3.5	People do not feel it but it is recorded on the scale.
3.5 - 5.5	Everybody feels it.
5.5 - 7.3	Buildings may collapse.
7.4 - 8.0	Serious destruction can be seen.
8.0 <	Completely destructive.

Major earthquake zones of the world

When observing map 6.2 the plate boundary zones can be identified as the areas where earthquakes occur constantly. The map 6.2 shows four major zones where earthquakes take place in the world.



Map 6.2 - Earthquake zones

A - The area that spreads around the Pacific Ocean. (Pacific Ring of Fire)

B - Mediterranean-Himalaya mountain zone.

C - Mid- Atlantic oceanic ridge.

D - The African Rift Valley Zone.

Impact of earthquakes

- Cracks and faults appear on the crust.
- Landslides and sinking of lands take place in mountainous regions.
- When earthquakes occur in the ocean bed they cause Tsunamis and destroy the coastal areas the nearby countries.
- Damage to human life and property, destruction of the natural drainage system and infra-structure facilities.

Activities

1. What is known as an earthquake?
2. Name the major earthquake zones located in the world and shade these areas on a world map.

Tsunami

The high and lengthy strong ocean waves caused as a result of the different tremors origin at the ocean bed, that approach the coastal areas are called Tsunamis.

Phenomena that create Tsunami waves

- Massive earthquakes and volcanic eruptions that occur in the ocean bed.
- Landslides that occur in the ocean bed.
- Fall of meteorites into the sea.
- Falling of large ice sheets from the glaciers into the sea.
- Powerful explosions made by man on the surface of the oceans.

Among them, the major factor that causes Tsunami waves is the earthquakes that occur in the ocean beds. As a result of sudden and powerful tremors occurring on plate margins, the ocean water is disturbed and creates large tidal waves on the surface of the ocean. When these waves approach land areas their height is increased gradually and they convert into Tsunami wave near the coast. These Tsunami waves cause severe destruction to the coastal areas. Fig. 6.5 shows how Tsunami waves are formed.

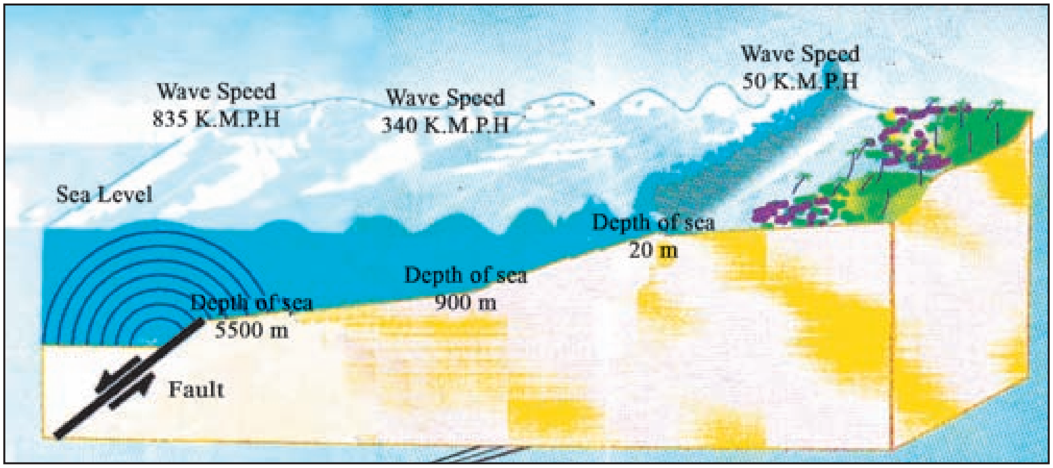


Fig. 6.5 - How a Tsunami wave is formed

Areas affected by Tsunamis.

Tsunami is often seen in the areas where earthquakes are caused.

- The coastal areas around the Pacific Ocean.
- East Indian coast line and the Indian Ocean.
- Coastal areas close to the Caribbean islands.

The impact of the Tsunami disaster

- Damage to human life.
- Destruction of the physical and human landscape of coastal areas.
- Obstruction to fisheries activities.
- Spread of epidemics.
- Displacement of the community and the psychological effect on the survivors.

Figures 6.6 and 6.7 show how the Banda Aache area in Sumatra islands has been destroyed due to tsunami in 2004.



Fig. 6.6 - Banda Aache area in Sumatra Before tsunami



Fig. 6.7 - Banda Aache in Sumatra After tsunami

Activities

1. What is a Tsunami?
2. Write down three major causes of Tsunami.
3. Name the areas that face Tsunami disasters in the world and mark them on a world map.
4. Explain the damage caused by a Tsunami citing examples.

Volcanoes

When the magma in the Earth's interior escapes through the cracks and the weak areas in the tectonic plate margins, it is called a volcanic eruption. After the eruption, the magma that flows on the surface of the earth is called lava.

At the beginning, smoke, ashes, different gases and pieces of lava are ejected to the atmosphere and at the same time lava flows through the crater (vent) of the volcano. The lava that erupted from the crater of the volcano flows around the volcano and deposits as cool solid layers. After that, the volcano becomes dormant. Although it is a dormant volcano it may become re-active causing a hazardous situation.

When a volcano erupts a huge damage could be caused to human life, property, as well as to infra- structure facilities.

The effect of the various substances emitted into the atmosphere during a volcanic eruption cannot be ignored.. In addition to that it could result short term changes in weather conditions and could obstruct air travel too as the ash plumes spread in the atmosphere.



Fig. 6.6 - A volcano Eruption

Distribution of volcanoes

Volcanoes are mostly found on tectonic plate boundaries. they are also found on plate subduction areas and in zones located out of plate boundary areas. 70% of active volcanoes are located in the Pacific plate margins around the Pacific Ocean. This is famous as the Pacific Ring of Fire.



Map 6.3 - Distribution of volcanoes

Impact caused by volcanoes

The information in the following table depict that the volcanoes cause various types of destruction.

Volcano	Year erupted	Destruction caused
1. Vesuvius (Italy)	79 AD	The whole city of Pompeii was destroyed and 16000 human lives were lost.
2. Vesuvius (Italy)	1631 AD	Eruption prevailed for two days. People of 15 cities of the surrounding area were affected by the disaster.
3. Krakatoa (Indonesia)	1883 AD	Presence of a dark sky for a number of days due to the emission of ashes and smoke with a large eruption. The tremors of the eruption surroundings caused a Tsunami and about 36000 people were killed.
4. Pelee (Martini Islands)	1902 AD	Killed 30000 people.
5. Pinatubo	1991 AD	Environmental pollution due the emission of ashes. Occurrence of heavy rain. Killed 5000 people.

6. Eyjafjallajokull (Iceland)	2010AD	Brought air travel in the European countries to a standstill for six days due to the spread of ash plumes in a large area of the atmosphere.

Activities

1. i. Find and name the countries where the following volcanoes are occurred.

   St.Helena, Parakuteen, Galapagose, Kilimanjaro, Hekla,Visuvius, Fujiyama, Pinatubo, Mayan, Krakatoa, Ruvapehu.

   ii. Mark those volcanoes on an outline map of the world.

2. Explain the damage that is caused to the environment due to eruption of volcanoes giving examples.

Drought

The main reason for drought is, unexpected delay in receiving rain for a number of days.



Fig. 6.9 - An area affected by drought

The British weather scientists define drought as a continuous time period of 15 days without rain. It is the duration of 30 days in Canada. In Australia the number of days is greater than this. Accordingly, various countries in the world define drought in different ways. However, it is apparent that the main reason for drought is the delay in receiving rain.

People have to face the hazard of drought when the water supply is not sufficient due to the changes in pattern of rainfall or due to decrease of the amount of rainfall. This hazard can be minimized to a certain level if water is provided.

The areas mostly affected by droughts in the world

- Central African Sahel zone.
- Midwest zone in North America.
- Central Australia.
- The areas of Hyderabad, Gujarat and Maharashtra in India.
- North western part of China.

Impact of droughts

- Presence of a severe water scarcity.
- Destruction of farm lands.
- Infertility of soil.
- Destruction in the bio diversity.
- Damage to vegetation cover
- Obstruction to hydro power generation.
- Humans and animals suffer from starvation and diseases
- Destruction of natural beauty.

Activities

1. Define " drought".
2. Name the major areas which are affected by droughts and mark them in an outline map of the world.
3. State the damages that are caused by droughts and present your ideas to minimize the impacts droughts.

Cyclones

The hard blowing wind spinning fast in a swirl originating with an intense centre of low pressure on the surface of the tropical oceans is called a whirlwind or cyclone.

A whirlwind is the origin of cyclones. The strong winds that gush into the land from the ocean cause severe damage and eventually die out.

The sea waves become stormy waves as a result of blowing the cyclone at a high speed towards the land from the ocean. The coastal landscape would be affected by this and incur heavy losses in the surrounding areas. A disaster condition may prevail due to heavy rain and strong winds.



Fig. 6.11- A cyclone

Areas affected by cyclones

The land areas located around the oceans where cyclones may occur can be identified as areas affected by this hazard. The tropical areas which have a specific weather condition such as Indonesia, Southern coastal areas of the United States of America and the surrounding areas of the Bay of Bengal can be cited as examples. Various names are used for these whirl winds according to the surrounding areas of each coast.



Map 6.4 - The effect of cyclones

Hurricane - in the North Atlantic Ocean.

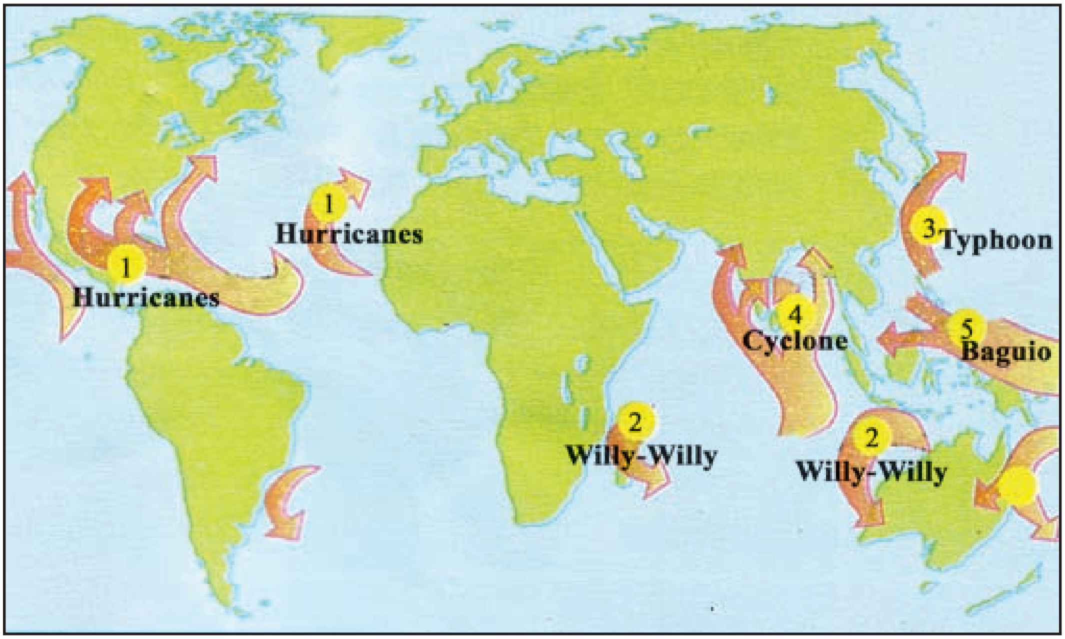
Willy-Willy - in the Indian Ocean close to the Southeast coast in Australia.

Typhoon - in the Pacific Ocean beyond the coast of East Asia.

Cyclone - in the Indian Ocean surrounding the Bay of Bengal.

Baguio - in the Pacific Ocean close to the Philippine islands.

Map 6.4 - Indicates the areas where cyclones occur in the world.



Map 6.4 - Areas where cyclones occur.

Activities

1. Name the areas affected by cyclones in the world and mark them on an out-line map of the world.
2. 'Cyclones are a destructive hazard'. Explain this with examples.

Impacts of cyclones

- Damage to land areas due to the gush of strong winds with heavy rain.
- Damages to the coastal areas due to the stormy waves and high tides.
- Damages to human life and property.
- Pollution of water sources with the flow of the ocean water due to the rising waves.
- Causing damages to infra-structure facilities such as communication systems and electricity lines.
- Obstructions to fisheries activities.
- Spread of epidemics.

Bush Fires

Occurrence of fire and its rapid expansion in forests, scrub lands and grasslands naturally or through human activities is called wild fire.

The climatic conditions such as drought and aridity increase the possibility of the occurrence of bushfires. Similarly, the vegetation in the areas where fire occurs is easily prone to fire. Various types of grass, dry scrub lands and trees can be cited as examples.



Fig.6.12 - A bush fire

Reasons for the occurrence bush fires.

Wild fires occur owing to physical effects as well as due to human activities.

Natural reasons	Human activities
• Severe droughts and dry winds. • Occurrence of fire due to abrasion of tree trunks together. • Lightning. • Volcano eruption.	• Causing fire due to carelessness. • Setting fire.

Countries where constant bushfire occur in the world

Australia	**China**
Canada	**Indonesia**
United States of America	**Central African countries**
France	

Impacts of bush fires

- Damages caused to human life, property and houses.
- Destruction of wild life.
- Causing damages to vegetation cover.
- Pollution of the atmosphere.
- Impacts on water sources and soil.

Activities

1. Explain how natural as well as human activities cause bush fires.
2. Name five countries where bush fires occur frequently and mark them on an outline map of the world.
3. Explain the damage that is caused to the environment due to bush fires.

Assignment

1. Using the information in the media, mark the places on an outline map of the world where high intensity earthquakes occurred recently and explain briefly their effects.
2. Prepare an article to the school wall paper about the occurrence of tsunami waves due to the earthquakes that occur on oceanic plate margins.
3. Name a few strong cyclones that occurred in the world recently and write the country and the year they happened. For example. Cyclone Katarina which happened in the state of Mississippi in the USA.
4. Prepare a hand out includes the proposals to the community to minimize the disaster caused by bushfire.

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Glossary

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- Earthquakes - භූමිකම්පා - புவிநடுக்கங்கள்
- Tsunami - සුනාමි - சுனாமி
- Volcanoes - ගිනිකඳු - எரிமலைகள்
- Cyclones - සුළි සුළං - சூறாவளிகள்
- Lightning - අකුණු සැර - மின்னல் தாக்கம்
- Drought - නියඟ - வரட்சி
- Bush fire - ළැව්ගිනි - காட்டுத் தீ
- Earth’s crust - පෘථිවි පෘෂ්ඨය - புவியோடு
- Strata of rocks - පාෂාණ ස්තර - பாறைப்படை
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- Retaining capacity - රැඳවුම් ධාරිතාව - எஞ்சியிருக்கும் இயலளவு
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- Volcanism - යමහල් ක්‍රියාවලිය - எரிமலையாக்கம்
- Fault - විභේද - குறை/ பிளவு
- Seismometer - භූ කම්පන මානය - புவிநடுக்க அலைபதி கருவி
- Seismograph - භූ කම්පා ප්‍රස්තාරය - புவிநடுக்க அலைபதி வரைபு
- Tectonic plate boundaries - තැටි මායිම් කලාප - புவியோட்டு தகட்டு எல்லைகள்
- Meteorites - උල්කාපාත - விண்கற்கள்/ ஆகாயக்கற்கள்
- Ocean waves - සාගර තරංග - சமுத்திர அலைகள்
- Eruption - විදාරණය වීම - கக்குதல்
- Crater / vent - යමහල් මුඛය - எரிமலை வாய்
- Origin - ප්‍රභවය - தோற்றம்
- Cyclone - වාසුළිය - சூறாவளி
- Swirl of winds - සුළං ප්‍රවාහ - காற்றோட்டம்
- Aridness - ශුෂ්කතාව - வரட்சித் தன்மை

7 Natural hazards in Sri Lanka

Many factors such as Sri Lanka being an island, the internal landscape , location within a tropical climatic zone and the high population affect the the occurrence of many natural hazards in Sri Lanka.

Landslides, floods, cyclones, lightning, and Tsunami are the major natural hazards that occur in Sri Lanka.

Studying about the natural hazards that occur in Sri Lanka, along with their impacts, methods to face them and ways of mitigating their impact, is the objective of this chapter.

If we could maintain the manmade human landscape, built to meet the demands of the community, free of hazards, it would help in accelerating the socio economic development of the country. It is evident that the frequency in the occurrence of hazard like landslides, floods, droughts are increasing in Sri Lanka. Building the human landscape without paying any concern to the physical environment and irregular management of the environment have adversely affected in intensifying such hazards.

Landslides

The sudden movement of soil, rocks and vegetation cover on a slope in an elevated area towards the lower areas can be called a landslide.

Landslides are a common phenomenon in the mountainous regions, especially in the hill country wet zone.

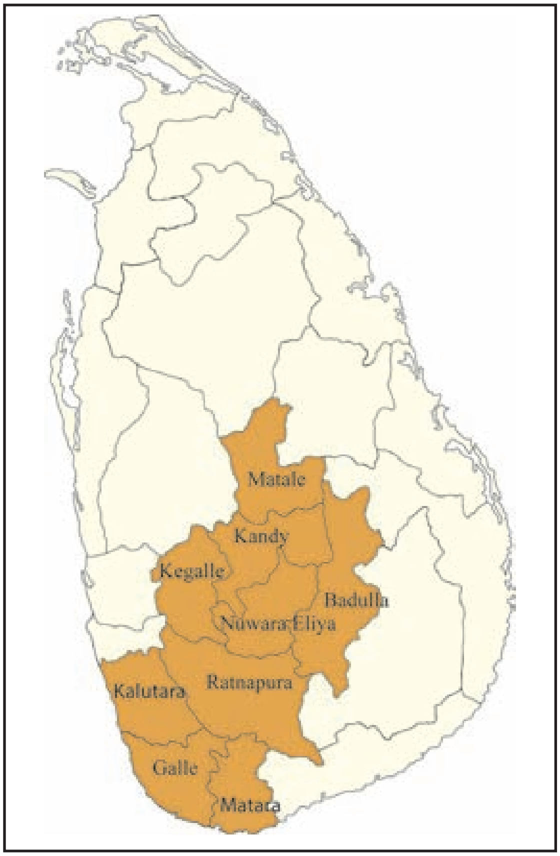


Fig.7.1- Land slide

Map 7.1 indicates seven districts in Sri Lanka which have been identified as areas prone to landslides by the Disaster Management Center.

Reasons for landslides

Natural reasons as well as human activities have affected the occurrence of landslides.



Map 7.1 - Areas affected by landslides

Natural reasons

- Occurrence of tremors.
- Heavy, incessant rainfall.
- Steep slopes in mountains.
- Structure of the stone layers and weathering of them.
- Poor drainage pattern.
- Decrease of the vegetation cover.

Human activities

- Improper use of the lands with slopes.
- Clearing the forests on slopes.
- Obstructing natural water ways.
- Mining in mountainous areas.
- Removal of earth, quarrying and breaking rocks using explosives.
- Improper constructions on mountain slopes.

Signs of an impending landslide

Particular changes in the immediate environment indicate the occurrence of a landslide in near future. The damage can be minimized if these features are identified accurately. Some of such signs are mentioned below.

- Appearance of cracks on houses and other buildings.
- Sinking or appearance of cracks in the land area.
- Inclination of trees, lamp posts and telephone posts in the area.
- Dying of large trees on slopes instantly.
- Changes in water sources in the lower areas of slopes.
- Changes in the behavioural patterns of certain animals.

Steps taken to minimize the hazard of landslides.

- Protection of the vegetation covers on lands with slopes.
- Not obstructing the natural drainage pattern.
- Following scientific instructions when using lands with slopes.
- Not building reservoirs in elevated areas.
- Not constructing buildings in the lands with steep slopes.
- Taking steps to protect the stability of the land areas with slopes. Examples- retaining walls, drains and forestation etc.
- Community awareness programme.

Activities

1. Explain what a land slide is.
2. Name and shade the districts identified by the Disaster Management Center in Sri Lanka as the areas threatened with landslide risks.
3. Explain in brief the damages caused by landslides.

Floods



Fig. 2.7 - A flooded area

Floods can be identified as the most common natural hazard in Sri Lanka. Floods can be seen in the areas that receive heavy rain and in the river basins and the areas around the estuaries of Kelani, Kalu, Gin, Nilwala, Mahaoya and Mahaweli rivers. Floods occur suddenly as a result of a rise in the water level of rivers and overflowing the either sides of the valleys and also as a consequence of obstructions of water ways. This hazard can be mostly seen in urban areas close to low lands. The human activity in the areas blocking the places where water drains naturally during heavy rains, intensifies the risk of floods in such areas.

The areas subjected to frequent floods.

- Low lands around river basins and estuaries.
- Urban areas located close to rivers.
- Eg: Colombo, Kalutara, Matara and Ratnapura.
- Low lands around tanks and reservoirs.

Reasons that affect the floods.

Natural reasons as well as human activities cause floods.

Natural reasons	Human activities
• Heavy rainfall • Overflowing of rivers, reservoirs and tanks. • Nature of the vegetation cover • Amount and the speed of the run off	• Obstruction of water ways • Obstruction of estuaries • Filling of wet lands and low lands • Removing the vegetation cover in low lands. • Developing settlements in lowlands.

At present, it is clear that human activities cause floods than natural reasons.

- Steps that can be taken to minimize the flood hazard.
- Not clearing the forests in the catchment areas.
- Keeping the estuaries open.
- Protection of the low lands and wet lands.
- Limiting the sand mining in rivers.
- Constructing buildings resistant to floods.
- Limiting human activities at the places where the tanks and rivers overflow.
- Community awareness programmes.

Activities

1. Name and mark some river basins in Sri Lanka, which are frequently flooded during the rainy seasons.
2. Name and mark some urban areas which are frequently flooded in the map you have drawn.
3. Draw a flooded area and colour it.
4. Write three steps that have to be taken to minimize floods.

Cyclone

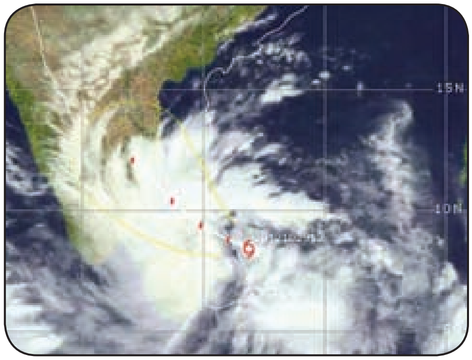


Fig. 7.3 - A cyclone in bay of Bengale

The depressions in the atmosphere that develop in the areas around the Bay of Bengal move as cyclones towards India or Sri Lanka. In Sri Lanka, cyclones occur mostly in the Northern and Eastern regions during the period from October to December. Map 7.2 indicates several districts which are mostly affected by cyclones. Even though heavy damages are not reported frequently, the cyclone that hit the country in November 1978 incurred heavy losses and many lives were lost too.

Although the general public could not identify this hazard beforehand, the meteorologists can identify it through the Satellite technology. Therefore, weather forecasts are useful to mitigate the impacts of this hazard to a certain level.

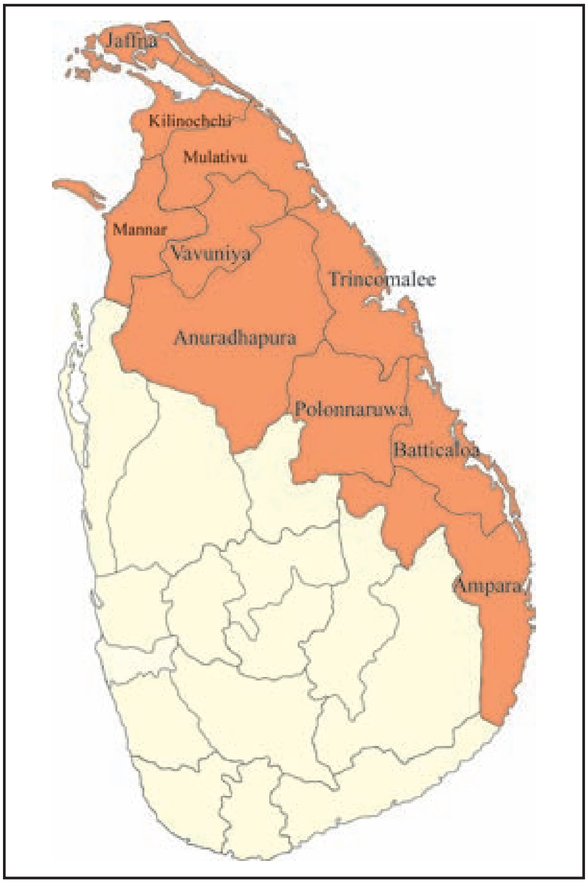


Fig. 7.4 - District affect by cyclones

Steps that can be taken to minimize the impact of cyclones.

- Paying attention to the weather reports.
- Removing trees grown close to houses.
- Making the roofs of houses stable.
- Preparation of strong wind shields.
- Moving to a place of protection when there is a strong wind.

Activities

1. Shade the areas in Sri Lanka which are affected by cyclones in an outline map of Sri Lanka.
2. Mention the damages that are caused due to cyclones and write three steps that can be taken to minimize them.

Drought

Various countries in the world have different definitions related to 'drought'. There are different ideas presented in Sri Lanka too. According to the report of climatic changes prepared by the Ministry of Forest resources and Environment, the duration of receiving less than 75% of expected rainfall in Sri Lanka is called the time duration that causes drought. However, the time periods of droughts in Sri Lanka vary in different areas.

The dry zone of Sri Lanka experiences a drought condition once in every three or four years. It is identified that drought condition that affects the whole Sri Lanka occurs in every ten years.



Fig. 7.4 - Cultivated land affected by drought



Fig. Map 7.3 - Areas affected by constant droughts

Reasons that cause droughts.

- Climatic changes.
- Increase in global warming.
- Pollution of the atmosphere.
- Destruction of forests.
- Unexpected scarcity of water.

Steps that can be taken to minimize the impact of a drought.

- Storage of rain water.
- Conservation of water sources and protection of the vegetation cover.
- Using water sparingly.
- Preference towards crops with water efficiency.

Activities

1. Mark and shade districts which are affected by droughts in a district map of Sri Lanka.
2. Name some crops resistant to droughts at least to a certain extent.
3. "Human activities affect the occurrence of droughts more than natural causes" Explain this with reference to two examples.

Lightning

Lightning is a natural phenomenon which is identified as a very common hazard in Sri Lanka. Especially during inter monsoonal period with the convectional process, lightning can be seen throughout the island.



Fig. 7.5 - Lightning

The reason for lightning is the higher cumulus clouds forming under unstable and humid atmospheric conditions during inter monsoonal periods. The electric discharge of positive and negative charges within the cumulus clouds is called lightning.

Lightning can be divided into three categories. They are,

- Cloud lightning (discharges between clouds and clouds)
- Air lightning (discharges between clouds and space)
- Earth lightning (discharges between clouds and the earth)

More damages are caused by earth lightning that occurs between the clouds and the earth. Although earth lightning may occur at any place in Sri Lanka, it has been identified more damage would cause in the areas that receive inter monsoonal rain in abundance.

Lightning causes more damages like loss of lives and destruction of property in Sri Lanka. According to the reports of the Disaster Management Center about 50 lives are lost annually due to lightning .In addition to that; taller buildings and electrical appliances are damaged mostly at the occasions of this hazard.

Steps that could be taken to prevent from lightning.

- Use earth wires connected to the electric circuits of buildings and houses.
- Install lightning conductors on taller buildings.
- Fix a trip switch to the electric supply at home.
- Disconnect electric and electronic appliances when lightning.
- Avoid staying in open spaces or under single trees.
- Avoid touching metals when lightning.
- Be alert and making others also aware about the hazard during a period of strong lightning.

Activities

1. Mention the time period that lightning occurs mostly in Sri Lanka.
2. Explain the damages caused by lightning.

Tsunami

Sri Lanka had to undergo the tragic experiences of Tsunami catastrophe on the 26th of December 2004. This hazard can be considered as the most tragic natural hazard that occurred in the recent history not only to Sri Lanka but in many countries in the Southeast Asia.

Tsunami waves were triggered after an earthquake that occurred on the plate boundaries located close to Sumatra islands, in an area known for earthquakes with a higher intensity. These tsunami waves tragically destructed the Northern, Eastern and Western coastal areas in Sri Lanka.

The coastal areas of Jaffna, Mullaitivu, Trincomallee, Batticaloa, Ampara, Hambantota, Matara, Galle and Kalutara districts were severely damaged.The death toll recorded was about 35000 while 500000 were recorded as displaced. Property and ecosystems with a immense value were too destroyed.

Steps that can be taken to minimize the damage caused by Tsunami



Fig. 7.10 –Tsunami waves

- Limiting construction work close to the coast.
- Protection of the natural eco-systems located close to the coast.
- Installing tsunami warning systems and community awareness.
- Soon after receiving tsunami warnings, evacuate from the coastal areas and move to a place with a higher elevation.
- If there are no elevated places in the vicinity, move to an upper floor of a building constructed with reinforced concrete.
- Listening to media.
- Listening to tsunami warning systems.
- Evacuate the coast when the sound of an earth quake is heard without waiting for the tsunami warning.

Activities

1. Explain what a tsunami is.
2. Shade and name the districts which were affected by tsunami hazard on the 26th of December 2004 in a district map of Sri Lanka.

Disaster Management Programme in Sri Lanka.

The disaster management programme became dynamic with the tsunami that struck on the 26th of December 2004 in Sri Lanka. A formal institutional structure was established with new laws, rules and regulations for disaster management in the year 2005.

The institutional structure related to disaster management.

- Establishment of a ministry related to disaster management.
- Establishment of a National Disaster Management Centre (NDMC) with political leadership.
- Establishment of a Disaster Management Centre (DMC) under a director general.
- Establishment of a Disaster Management Centers in divisional secretariat divisions and district levels.
- Implementation of school programmes related to protection from hazards.

Through the above institutional structure, many community services are performed related to hazardous situations that occur at any place in Sri Lanka. Prevention from hazards, hazard mitigation, responding and rehabilitation activities related to them are included in the management programme. Not only the state sector but community based organizations and non-government organizations also actively contribute towards disaster management activities in Sri Lanka.

Disaster Management Cycle

Disaster management cycle is the model that indicates the process of hazard management. It shows a dynamic management activity from the pre-hazard level to the post – hazard level.



Fig.7.11 - Hazard management cycle

Preparation

- Attempting to identify the features that occur prior to the hazard.
- Forecasting related to the hazard.
- Preparation to face the hazard.

Response

Although responses may change according to each hazard the necessity of responding to any hazard is compulsory.

- Assuring the protection of the community subjected to the hazard.
- Providing medical treatments.
- Protection of physical property as much as possible.
- Providing temporary lodging.
- Providing food.

Recovery

This includes the necessity of rehabilitation of the environment and the people subjected to the hazard. Planning long term and short term actions is significant in the recovery process. This encompasses recovery of people who were both physically and mentally victimized by the hazard.

Mitigation

The steps taken to minimize the hazard are similar to the steps related to preparation. However, the risk of the hazard can be minimized through other steps.

- Installing warning systems.
- Community awareness and participation.
- Introduction of some implements that can be used to minimize the hazard.
- Strengthening disaster management institutions.

Activities

1. Name natural hazards that occur in Sri Lanka frequently.
2. Select any two hazards and prepare a list of steps that can be taken at each stage of the Disaster Management Cycle.

Assignments

1. Identify the natural hazards that occur in your living area.
2. Collect information related to the natural hazards that occurred in your area and their effects and prepare an article to the school wall paper.
3. Explain in brief what you have heard about the behavioural patterns of certain animals before a natural hazard.
4. Find information through media and prepare a list including the damages caused due to lightning in Sri Lanka.
5. Prepare a poster to make people aware including the steps that could be taken to minimize the hazard of lightning.
6. Prepare a report related to the damage caused by tsunami in Sri Lanka obtaining information from newspapers and your elders to be presented to the classroom.
7. Prepare a list of proposals to uplift the physical and mental conditions of the people affected by hazards.

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Glossary

- Cleavages - පැළුම් තල - பிளவுத் தளங்கள்
- Run off - අපධාවය - கழுவு நீரோட்டம்
- Cloud lightning - වලා අකුණු - முகில் மின்னல்
- Air lightning - වායු අකුණ - வளி மின்னல்
- Earth lightning - පෘථිවි අකුණු - புவிமின்னல்
- Lightning conductor - අකුණු සන්නායක - மின்னல் தாங்கி
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- Mitigation - අවම කිරීම - தணிப்பு

8 Climatic Changes

Flora and fauna in a particular region is adapted to the climatic conditions prevalent in that region. The human activities too are adapted to the climatic and the other physical conditions in that region. The modern man is advanced in science and technology even to carry out certain human activities under controlled environmental factors. Some human activities are not eco-friendly and have harmful effects on the environment. Some examples are,

- Mining of mineral oil resources in the North Sea.
- Air conditioning.
- Commercial dairy farming.
- Burning of fossil fuels.
- Deforestation
- Nuclear experiments.
- Disposal of solid waste.

The above activities have caused changes in many cyclic processes in the physical environment. Thus we have to face many unfavourable consequences such as Global warming. Climatic changes are quite significant among them.

Certain environmental processes take place gradually and in a cyclic manner. When they occur suddenly, it brings about changes in the atmospheric composition and results global warming. This condition eventually creates extreme conditions in the climate.

As a result, changes have occurred in patterns of winds, droughts, cyclones, duration of receiving rainfall and the intensity of rainfall and environmental temperature. These changes can be called climatic changes. Accordingly, the long term or short term changes occurring in the general climatic pattern on earth are identified as climatic changes.

The objective of this chapter is to study the climatic changes, phenomena that cause climatic changes, impact of the climatic changes on physical and human environment and about the global agreements and conventions related to this issue.

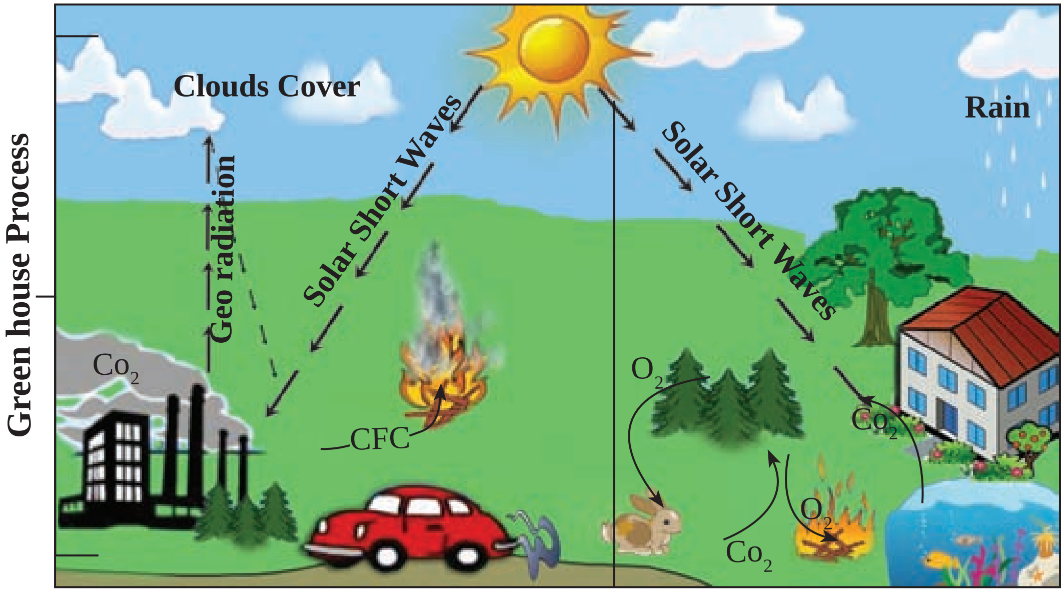
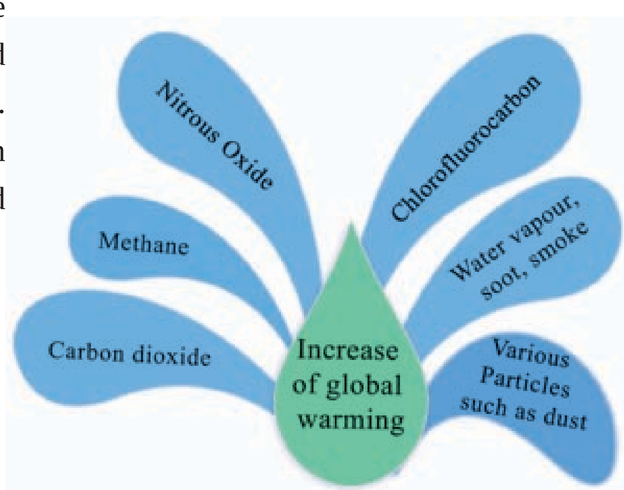


Fig.8.1 - Change in environment cycles and their impacts.

The short wave solar radiation from the Sun is reflected back to space as long wave radiation (terrestrial radiation). Due to the effect of greenhouse gases in the atmosphere the rising terrestrial radiation remain in the earth's atmosphere and this is called the natural greenhouse effect. An atmosphere conducive for for the living beings is created on earth due to this phenomenon. However, due to various human activities, an exceeding amount of greenhouse gases is emitted to the atmosphere. These gases absorb more radiation and in turn warm up the atmosphere. This causes an increase in global warming. (Accelerated Greenhouse Effect)

Human activities as well as natural reasons have affected the increase in global warming.



Human activities as well as natural reasons have affected the increase in global warming.

Human activities

- Burning and over using fossil fuel.
- Deforestation
- Industrialization
- Animal husbandry (ruminants)
- Disposal of solid waste
- Setting fire
- Nuclear experiments

Natural reasons

- Eruption of volcanoes
- Bushfires
- Natural marshy lands
- Changes in the space
- Sun spots

Increase in global warming may cause the following unfavourable situations.

- Occurrence of climatic changes.
- Rise in sea level due to melting ice in polar regions.
- Destruction of lagoons and salinization of water.
- Increase of temperature in oceans and destruction of aquatic organisms.
- Occurrence of cyclones due to increase in the temperature on the surface of oceans.
- Change of climatic boundary zones.
- Extinction of certain animals and emergence of new species.
- Destructions of animal genes and creations of abnormalities.
- Destruction of crops and decrease of yield.
- Changes in animal breeding zones.
- Pollution of drinking water sources.

The impact of climatic changes on human activities.

- Decrease in income of fishermen due to the reduction of fish harvest.
- Decrease of the crop lands due to salinity of soil.

- Spread of diseases due to increase in numbers of the insects that transmits diseases (vectors).
- Decrease in the harvest of agro-crops.
- Increase in natural hazards (cyclones, droughts and heavy rainfall).
- Obstruction for agricultural activities due to the changes in the patterns of rainfall.
- Loss of settlements when lowlands submerge in sea.
- Contamination of drinking water.

Minimizing climatic changes

Citizens in any country do not like to stay away from the lifestyle they enjoy, personally or commonly, or to be satisfied by fulfilling their needs at the minimum level. If they do, it is possible to refrain from unfavourable environment restricted activities or to minimize such human activities.

Following are some of the activities that can be done to minimize climatic changes.

- Less consumption of energy sources that emit green house gases.
- Motivation to use energy sources such as wind and solar power.
- Using organic manure for crop cultivation instead of chemical fertilizers.
- Management of solid waste materials.
- Expansion of afforestation.
- Introduction of mixed crops and multi crops.
- Using common transportation facilities.

Steps that have been taken to minimize climatic changes at a global level.

Both developed and developing countries are continuously engaged in development activities. While employing development strategies each and every country has contributed towards global warming and occurrence of climatic changes. Contribution to the climatic changes varies according to the capacity of energy and fossil fuel consumption of each country. The "World Conservation Strategies" were prepared by the "International Forum of Nature Conservation" as

a result of understanding this situation. Funds are provided by the United Nations Environment Protection programme and the World Wild Life Fund for that mission. They have three main objectives;

- To maintain essential ecological processes and life-support systems.
- To preserve genetic diversity.
- To ensure the sustainable utilization of species of flora and fauna and eco systems

Following are the milestones of this programme.

- Stockholm Summit held in 1972.
- Brundtland Commission Report. (1987)
- Earth Summit held in Rio de Janeiro in 1992 (International Conference on Environment and Development).

It was proposed to prepare a programme on environment and development for the 21st century at the conference held at Rio de Janeiro in 1992, with the participation of delegates from 172 countries.

Sri Lanka too agreed to the decisions made at this conference as a member country. As a result, a number of programmes were proposed to be implemented simultaneously at national level for the preparation of better surroundings in the environment.

- Minimizing activities that emit CFC gas and complete elimination after 2000.
- Vehicle emission tests.
- Solid waste management.
- Minimizing the use of fossil fuels.
- Protection of global bio-diversity by protecting animal and plant species.
- Consumption of regenerating energy (solar power ,wind power and hydro electricity).
- Green forest cultivation, tree planting programmes, roof-top cultivation, using organic fertilizer.

Inter-governmental Panel on Climatic Change. (IPCC)

Climatic changes is a theme which has drawn attention of many in the world recently. Therefore, the United Nations Organization established the Inter governmental Panel on Climatic Change (IPCC) in 1988.The membership for this organization is granted for those members of World Meteorological Organization and the United Nations Environment Project (UNEP). At present, 120 countries have received the membership of this organization. According to the programme Convention of the United Nations the organization of Inter governmental Panel of Climatic Changes provides reports about the climatic changes of these areas.

The Nobel Prize was awarded to both IPCC and ALGORE in 2007 for the reports published on world climatic changes.

Glossary

- Animal and plant community - සත්ත්ව හා ශාක ප්‍රජාව - விலங்கு மற்றும் தாவர இனங்கள்
- Air conditioning - වායු සමනය කිරීම - குளிரூட்டுதல்
- Commercial dairy farming - ව්‍යාපාරික ගවපට්ටි පාලනය - வர்த்தக பாற் பண்ணை
- Fossil fuel burning - පොසිල ඉන්ධන දහනය - உயிர் சுவட்டு எரிபொருள் தகனம்
- Nuclear testing - න්‍යෂ්ටික අත්හදා බැලීම - அணுப் பரிசோதனை
- Intensity of rainfall - වර්ෂාවේ තීව්‍රතාව - மழைவீழ்ச்சிச் செறிவு
- Global agreements - ගෝලීය එකඟතා - பூகோள ஒப்பந்தங்கள்
- Short waves - කෙටි තරංග - சிற்றலைகள்
- Long waves - දිගු තරංග - நெட்டலைகள்
- Green-house effect - හරිතාගාර ආවරණය - பச்சை வீட்டு விளைவு
- Global warming - ගෝලීය උෂ්ණත්වය - பூகோளம் வெப்பமடைதல்
- Sunspots - සූර්ය ලප - சூரியப் புள்ளிகள்
- Animal breeding zones - සත්ත්ව අභිජනනීය කලාප - விலங்கினங்களின் கலப்பின வலயங்கள்

- Bio-assisted systems - ජෛව සහායක පද්ධති - உயிர் - உதவித் தொகுதிகள்
- Renewable energy - ප්‍රතිජනන බලශක්ති - மீளுருவாக்கச் சக்தி
- Green forestation - හරිත වන වගාව - பசுமைக் காடாக்கம்
- Tree Planting Programmes - රුක් රෝපණ වැඩසටහන් - மர நடுகை நிகழ்ச்சித் திட்டம்
- Balcony cultivation - සඳළුතල වගාව - மாடி வீட்டுத் தோட்டச் செய்கை
- Intergovernmental Panel on Climate Change (IPCC) - දේශගුණ විපර්යාස පිළිබඳ අන්තර් ආණ්ඩු මණ්ඩලය - காலநிலை மாற்றங்கள்தொடர்பான அரசாங்களுக் கிடையிலான குழு
- United Nations Programmes Convention - එක්සත් ජාතීන්ගේ වැඩසටහන් ප්‍රඥප්තිය - ஐக்கிய நாடுகளின் நிகழ்ச்சித் திட்டச் சமவாயம்

9 1: 50 000 Topographical Maps of Sri Lanka

A map is very important to have a total study of the landscape of a particular area. You have already studied about maps, basic features of thematic maps and topographical maps and peripheral information of maps in Grade 10.

The objective of this chapter is to study about the physical and cultural features in topographic maps, learn to draw a cross section of a physical landscape and learn to interpret maps in this lesson.

There are many features such as the topographic features , drainage, coastal features, natural vegetation, administrative boundaries, transport routes, cultivation, settlements and several other specific features on a mapped area of topographical maps,. These features can be classified as natural made and manmade features. They are also known as physical features and cultural features respectively.

When you learn about the peripheral information and information on the map face of a 1:50,000 topographical map you will be able to read the map and obtain complete knowledge about the mapped area.

Activity

Identify and name the physical and cultural features found in the area surrounding of your school or home.

The physical features of a 1: 50 000 topographic map

Features which are naturally formed on land are known as physical features.

These physical features can be divided into four main parts.

- Relief features.
- Drainage features.
- Coastal features.
- Natural vegetation.

The Relief Features

Different landforms on the surface of the Earth are represented by contour lines on 1: 50 000 topographic maps. The places with equal height are marked after measuring the height of a certain area .Then lines are drawn on a map connecting the places with equal height. These lines are known as contour lines.

The value of each contour line is marked by height. The contour line interval is 20 m. The index contour lines such as 100 m, 200 m, and 300 m are drawn as dark thick lines in brown. Intermediate contour lines between two index contour lines are marked in light brown at 20 meter intervals. All the contour lines are not marked with the height. In mountainous areas where there are more contour lines, the index contour lines like 100, 200, 300 are marked with the value and the values of intermediate contour lines are determined according to the interval between two index contour lines.

As the contour line gap becomes wide in areas with extending plains, spot height is shown to get the idea about the elevation of the region. The height of the mountain peaks are also shown by trigonometrical stations. There is a note on contour lines in peripheral information of the topographical maps. Various lands forms like plains, mountain ranges, plateaus, valleys, spur and slopes can be identified by studying height, gap and spreading of the contour lines.

Identifying Relief Features



Fig. 9.1 - The Plain

Plain

A plain is a flat area on the land. Flat land can be identified on a map either by the limitation of contour lines to few or by the wide gap between two contour lines. The change of the height that occurs here and there, in these regions can be understood by the spot height.



Fig. 9.2 - Undulating Land

Undulating Land

The region of a plain that consists of slightly higher lands and low lands is known as undulating land. Such undulating feature can be found mostly in the coastal regions of Sri Lanka. The undulating lands on maps can be identified by the location of contour lines that show the scattered high lands between two contour lines with a wide interval.

High Lands



Fig. 9.3 - Highland. Valley Spur

A land with a higher elevation located in a particular area is known as a highland. More contour lines are located in a high land and they run very close to each other. Different landforms like mountain ranges, plateaus and spurs are found in a high land.

Valley and Spur

A Valley is an elongated low land mostly located between two high lands with a river flowing through. Valleys can be identified in low lands as well as in high lands. Wide shallow valleys in low lands and narrow deep valleys in high land regions are seen. Since the contour lines extend towards the high land in a V shape, a valley can be identified easily.

The part of high land that extends towards the low land with contour lines is called spur. In a spur the contour lines spread pointing towards the low land.

Mountain Range/ Ridge

High lands that extend with a narrow elongated shape are known as mountain ranges. Such mountain ranges are mostly found in the central hills of Sri Lanka. Lands

with low height extending continuously in flat lands are called ridges.

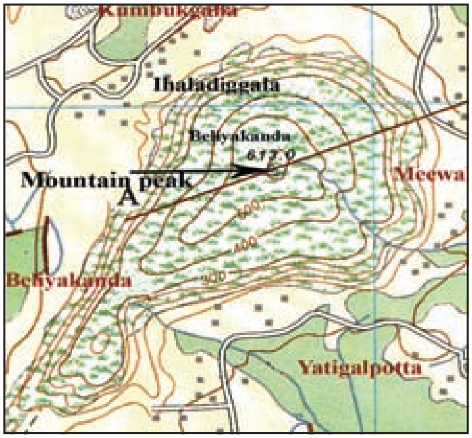


Fig. 9.5 - Mountain Peak.

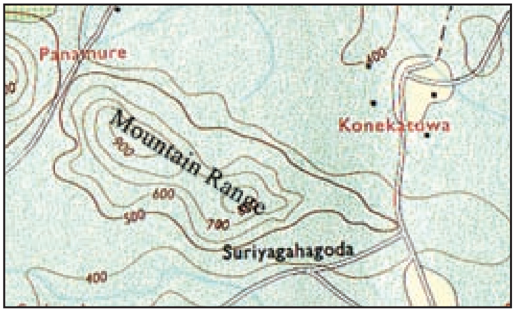


Fig. 9.4 - Mountain Range.

Mountain Peak

The height of the peaks located in a mountain range is shown by a trigonometrically station. There may be several peaks located at different heights in a mountain range.

Isolated Hill and Conical Hill

Solitary low hilly regions scattered in flat lands are called isolated hills. Generally they are around 100 to 200 meters in height. When an isolated hill is located in the shape of a cone, it is known as conical hill. In a conical hill contour lines extend in circles.

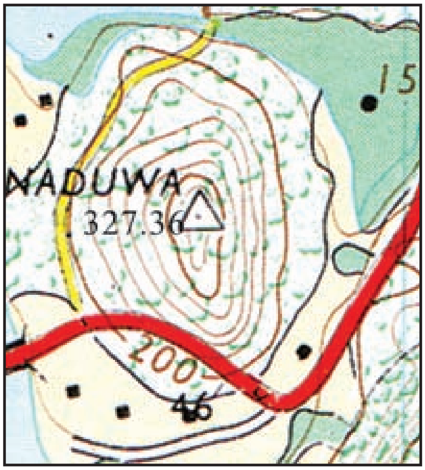


Fig. 9.6 - Conical Hill

Slopes

High lands can have different types of slopes. These slopes can be identified by the gap among the contour lines and by how they spread. If contour lines extend at a distance from each other gentle slope is shown and if the contour lines extend close to each other a steep slope is shown. Location of contour lines very close to each other is a special feature of an escarpment. On some occasions .contour lines in an escapement extend very closely like over lapping. Waterfalls are formed mostly, associated with escarpments. Sometimes, gentle slopes and steep slopes could be found even on the same slope. When a gentle slope is located on the higher part of a slope and a steep slope is located on the lower part of it, it is called convex slope.

When a steep slope is on the higher part of the slope and a gentle slope on the lower part on the slope are seen, it is called a concave slope.



Fig. 9.7 - Features of Slope

Gap

The lower region located between either two mountain ranges or between two peaks of a mountain range is known as a gap. If a river flows through a gap it is a water gap / pass. In the construction of roads in hilly areas such gaps are utilized to build the roads through them.

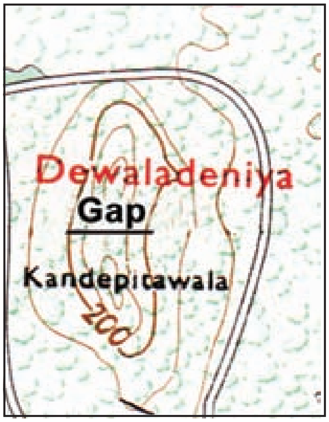


Fig. 9.8 - Gap

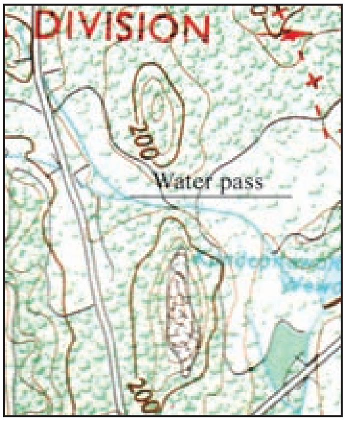


Fig. 9.8 - Water pass / gap

Activity

Select a part of a topographic map and draw the physical features of that region.

Drawing a Cross Section of a physical Landcape

The plan that is drawn to a scale to show the profile of a certain Physical Landscape on a line drawn joining two places on a map is called a cross section.

The cross section is useful to identify the Physical Landscape of a certain area clearly.



Map 9.1 - Topographic Map

Drawing a Cross Section

Step one.

- First draw a line (A-B line) joining two relevant places as shown on the map 9.1.
- To draw the base line, draw a line equal to the length of the A-B line. Draw two vertical lines at the ends of this line and mark the vertical scale on one line. While the scale of the map is the horizontal scale, suitable scale can be used for the vertical scale. Consider the elevation of the mapped area when determining it. According to the above map, elevation of the mapped area is seen just above 0- 600m. It is appropriate to use 1 cm=100 m(2mm=20 m) as vertical scale to show this elevation. Draw the sufficient number of horizontal lines parallel to the base line to that interval so as to show the relevant elevation.

Step two.

- Take a sheet of paper for the creation of the cross section and line up an edge of it on the A-B line drawn on the map.
- Mark the places where contour lines meet the base line with dots or dash alone the edge of the paper and write the values of the contour lines.

Step Three

- Line up the edge of the paper on the base line of the graph you have drawn. Next, move the edge of the paper to the 100 m line and marked the places where 100 m height is marked, on the scale line of the graph by a dot.. Next take the paper to the 200 m scale line and mark the places as you have done before. So mark all the heights on the relevant scale lines of the graph.
- When all the places have been marked join the dots by a line. When the mountain top is drawn draw the line there without touching the above scale line in to a shape of a peak.. In low valleys, draw the line without touching the lower line moving downwards from the dotted places in to a shape of a valley.
- To complete the drawing of the cross section join the line to two vertical lines considering the elevations of beginning and ending points.
- By shading the part that shows the landform with light brown, the landscape is clearly shown.

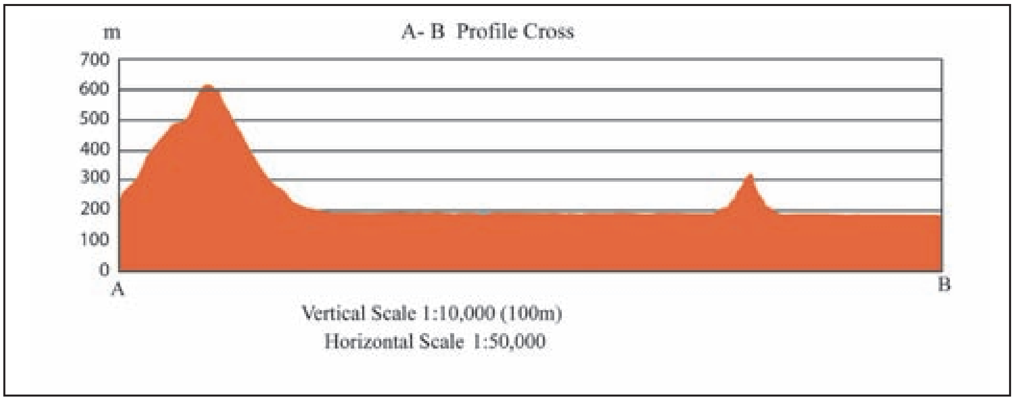


Fig. 9.11 - Cross section

In the drawing of a cross section the following features must be there.

- The heading should be stated.
- Mark "m" (metre) at the top terminal of the vertical axis.

- Mark “0” at the beginning of the vertical axis.
- State the vertical and horizontal scales.
- When a cross section is drawn to show a higher region, after contracting the vertical scale from zero to the beginning of the elevation, relevant elevations must be marked.

Activity

Draw the cross sections of above described valley, spur, concave slope, convex slope and conical hill following the instructions given by the teacher.

The Drainage Features

A river originates as a small stream in a hilly region. When several small water ways get collected a tributary is formed and when several tributaries join together the main river is formed.



Fig. 9.11 - River system

When the main river, all its tributaries and streams connected to the tributaries are considered together, it is called a river system. There are 103 main river systems in Sri Lanka.

Most rivers begin in the central hills and flow through the low plains following the relief of the land before falling into the sea at different places in the island.

Due to the flow of the rivers through longitudinal valleys located between two mountain ranges or between two high lands and through transverse valleys that run across mountain ranges, different types of drainage patterns are formed.

Catchment area and Watershed

The region from where a certain river collects water or the region that feeds a river is the catchment area. When several tributaries flow into the main river in the catchment area, the main river is fed. The central hill is the catchment area for most rivers of Sri Lanka. The boundary that divides two river systems is called water shed. When rivers flow on either side of one mountain, the top of that mountain range becomes the water shed.



Fig. 9.12. - Longitudinal valley and Transverse valley.

Waterfall

Most often, when rivers flow, even with a less volume of water, through narrow valleys in high lands with escarpments waterfalls are formed. Several waterfalls formed in such a manner can be seen in the central hills. Waterfalls such as Dunhinda, Bambarakanda, Diyaluma can be shown as examples.



Fig. 9.13. - Catchment area and watershed

Meander

The feature that is known as a meander is formed when a river begins to flow in a circular path due to the blocking of the river course by the deposition of the river burden as river flows very slowly through wide valleys in flat areas.



Fig. 9.14 - Marshy land, Meander and Braided river

Marshy Land

Marshy lands are formed due to the logging of water in the low lands associated with rivers. Blocking of the water ways of rivers too is a cause for the formation of marshy lands. Collection of rain water in low lands also causes to form marshy lands. Marshy lands are represented in topographical maps by a special symbol.

Braided River

When features like small islands are formed in the river due to the deposition of sediments in the middle of the river while the river flows very slowly through low plains, it is called a braided river.

Distributaries

A river which flows across low land at slow speed divides itself into several channels, flows is into main river after a short distance, is called cut off channels. Some rivers divide themselves into several channels at the river mouth and flow to the sea. These channels are known as distributaries. Eg. River Mahaveli flows into the sea through several distributaries at Trincomalee.

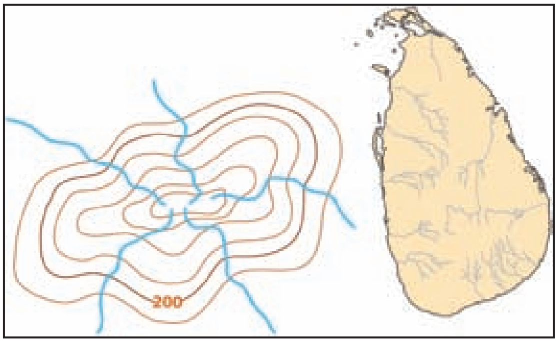


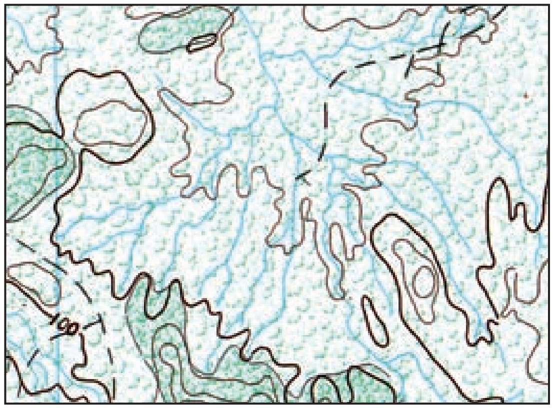
Fig. 9.15. - Radial drainage pattern

Drainage Patterns

The drainage pattern of a certain area is formed by the relief and the composition of rocks of that region. The drainage pattern that is formed due to the flow of rivers into different directions from the high land where they get originated is called radial drainage pattern. The total drainage pattern of Sri Lanka that consists of

a central hills in the mid of the island and low lands around it shows the features of the radial drainage pattern.

If the tributaries of a river system join the main river in the shape of branches of a tree is called a dendritic drainage pattern. In most of the river systems of Sri Lanka a dendritic drainage pattern can be seen.


Fig. 9.16. - Radial drainage pattern

When the tributaries of a river system meet the main river at a right angle forming the shape of a grid, it is called trellis drainage pattern. This drainage pattern can be identified in the south western plain of Sri Lanka. The location of the longitudinal and transverse valleys associated with the parallel ridges located in the south western region of the island has contributed for the formation of such drainage pattern.



Fig. 9.17 - The Dendritic Drainage Pattern

The main rivers like Kelani, Kalu flow from the central hills through the transverse valleys of the south western parallel ridges and the tributaries join the main rivers flowing through the longitudinal valleys located among the parallel ridges. On the 1: 50 000 topographic maps of South Western region of Sri Lanka such trellis drainage pattern can be seen.

Coastal Features

The relief features can be seen in the coastal areas on 1:50 000 topographic maps too belong to the physical features.

Lagoon, bay, head/point, sandbar, river mouth islands are the distinct topographical features of the coastal region. These coastal features are formed due to the erosion and deposition that occur along the coast line. Rivers flowing from the inland, structure of the rocks of the coast line and tides are some factors that have led to the formation of coastal features.

Islands

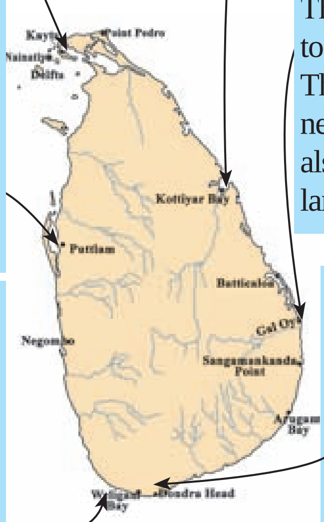
A land surrounded by water on all sides is known as island. In Sri Lanka on the North, West and Southwestern there are many such islands located close to the coast line of Sri Lanka. Delfts, Kayts, Nainativu are few islands located in the coastal region of North.

Lagoon

The topographical feature that is formed when the sea indents towards the land and is separated by a sand belt but with a small opening towards the sea is termed a lagoon. Eg: Negombo, Batticaloa and puttalam

Point/ Head

The narrow land on the coastal belt jutting out to the sea is known as "point" Dondra Head, Point Pedro and Sangamankanda Point are examples.



Bay

The indented area of the sea towards the land with a bigger opening to the sea is a bay. Arugam Bay, Kottiyar Bay, and Weligam Bay can be shown as examples. Bays are used as fishing habours where small fishing boats are anchored.

River Mouth

The place where a river flows to the sea is a river mouth. There are sand banks formed near the mouth of the river and also marshy lands close to the lands of the river mouth.

Sand bank

The sand brought by the waves and the rivers being deposited along the coastal belt leads to the formation of sand banks.



Map 9.2 - Coastal features

Natural Vegetation - The scrubs, forests, grasslands and mangroves that grow naturally on the land belong to by the natural vegetation. They are shown on topographic maps symbols. Relief, soil and climate influence the distribution of the natural vegetation.



Fig. 9.18 - Forest and scrubs

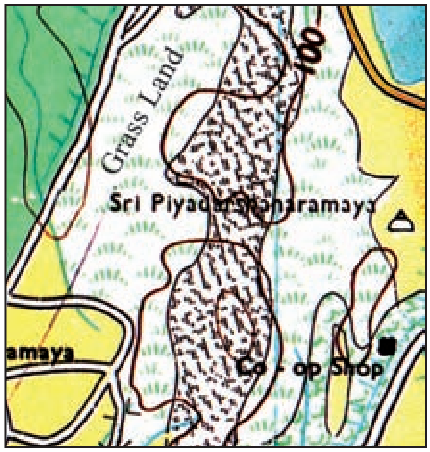


Fig. 9.19 - Grass land

A topographic map represents the total landscape of a region. While the physical landscape can be understood by the identification of physical features, human landscape can be understood by the identification of cultural features.

Identifying Cultural Features of a topographic map

The way how man has utilized the land and features formed on it can be identified as cultural features. In the key of the topographic maps these cultural features have been indicated mainly under the headings of boundaries, tourist information, roads and paths, and railway lines. Some cultural features have been mainly included under the headings of drainage, natural vegetation and general features.

The way how the distribution of human activities that is formed on the physical landscape is represented by using different symbols and colors, can be understood by reading the map.

Activity

Neatly draw the symbols that represent the cultural features under relevant main headings after studying the conventional signs of a 1:50 000 topographic maps.

Types of Boundaries

All the administrative boundaries on 1: 50 000 topographic maps are shown in red using different symbols. Though the boundaries of sanctuaries and forest reserves are included among them features that belong to the physical environment can be found in sanctuaries. It must be understood that though these boundaries are seen on the maps , they are invisible cultural features on the land. When you observe a map it will be clear to you that physical features like rivers, mountain ranges are used as the boundaries that divide the administrative units.

Tourist information

Information like the rest house, the hotel, historical places necessary for the tourists, are presented by symbols on the topographic maps. It is important to be well aware of these symbols and colors which are used to represent each feature when reading maps.

Roads

The symbols that represent roads on topographic maps are given under the headings of roads and paths and railway lines. Though the recently constructed express ways have not been shown on the maps, they will be included on the maps printed in future.

Water Supply

The symbols that represent tanks and irrigation that show the water supply in a certain region come under the cultural features. These features are shown by the symbols under drainage.

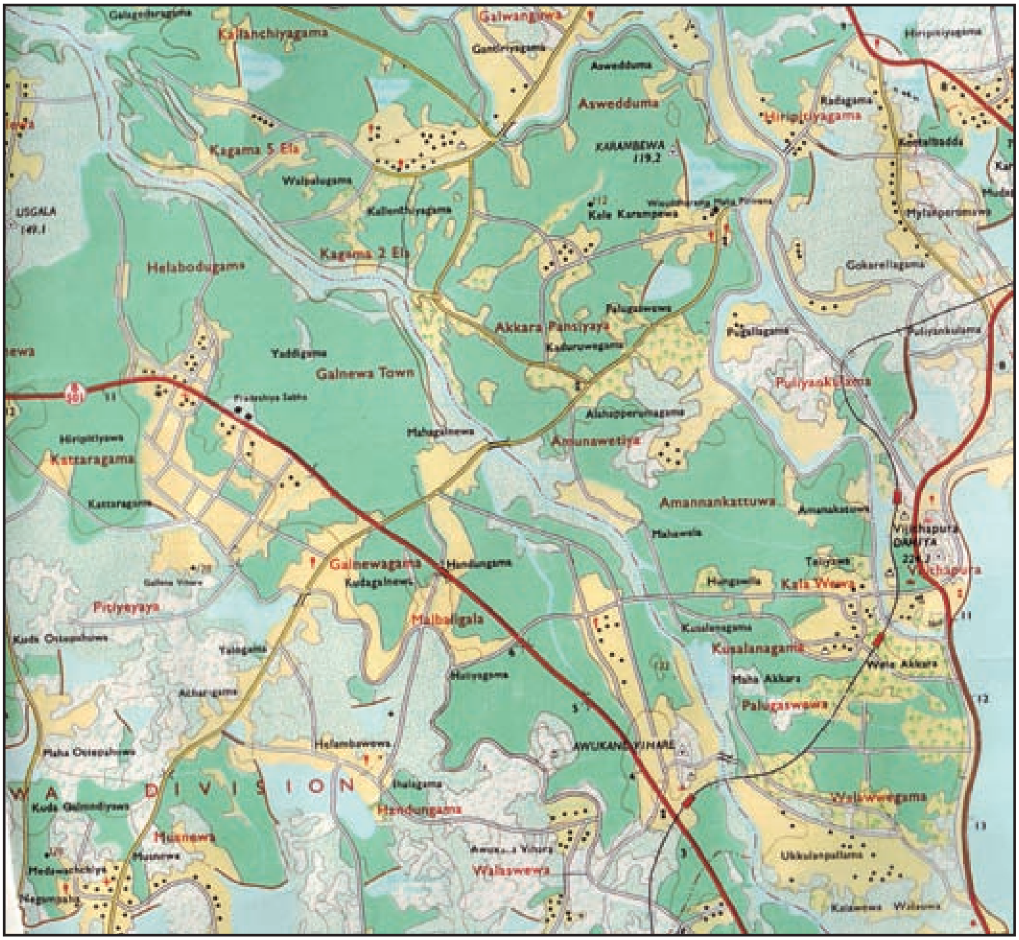
Cultivated lands

Cultivated lands that come under cultural features are shown under vegetations on topographical maps. The symbols which are used to identify the chief crops cultivated like paddy, tea, rubber, coconut and other crops as well as home gardens are included here. When cultivated lands are represented, paddy lands are shown in green, home gardens in yellow, green symbols on a yellow background are used for other crops. It is very important to have a correct identification of all crop cultivations by symbols, when the landscape of the mapped area is interpreted.

Special Buildings

Special buildings come under the "other features" category. Permanent buildings are shown using a small black square and special buildings are shown using a square a bit larger than that. The name of the special building is mentioned on the map. Significant public buildings are shown using symbols and they can be identified as public service centres and religious buildings. The built up areas marked in pink on urban areas are significant among the cultural features.

Different symbols used to depict cultural features are not drawn to a scale. Therefore, they are to be considered only as symbols used to identify different cultural features.



Map 9.3 - The cultural Features.

Activity

Studying the conventional signs on 1:50 000 topographic maps, draw and name the cultural features represented on the map 9.3 using relevant colors and symbols.

Interpreting Maps

Both the physical landscape created by nature itself and the cultural landscape that has been built on it by man over a longer period, are represented by the 1: 50 000 topographic maps. Hence by reading a map it becomes clear that there is an important relationship between the physical features and cultural features of the mapped area. The establishment of the road pattern, agricultural land use pattern, irrigation system and the settlement pattern compatible with the relief pattern of a certain area can be shown as examples.

When topographic maps are observed a road pattern that spread straight in the flat areas and a road pattern that runs through passes with bends in hilly areas can be identified. The roads in hilly areas are mostly built along the river valleys.

When the agricultural land use of the mapped area is considered, it becomes clear that crops are grown to match the land. Wide paddy lands in low plain areas and associated with river valleys , narrow long paddy lands in river valleys in hilly areas , tea cultivation in hilly regions rubber cultivation in gentle slope regions , coconut cultivation in coastal and suburb regions and Chena cultivation close to the scrub forests in the districts of the Dry Zones can be cited as example.

When the water supply of a certain region is considered, the features like construction of large irrigation systems associated with the river valleys, construction of tanks blocking the rivers that flow through the narrow gaps by building dams joining the spurs of the ridges located on either side of the rivers and cultivation of the lands located below the dam can be identified as the cultural features formed compatible to the relief of the land.

When maps are observed it is clear that the relief of any area influences the formation of the human settlement pattern . While the settlements spread over a wide area in plains, scattered small settlements can be found located in valleys in hilly areas. When interpreting maps, attention must be focused on both settlement pattern and also the type of settlement . According to the distribution of settlements linear, cluster and a scattered settlement patterns can be identified. A linear settlement pattern along the roads and narrow land belts and cluster settlement patterns at road junctions can be seen.

According to the life pattern of the people different settlements like tank settlements, fishing settlements, estate settlements can be identified. Settlements are again divided as rural and urban settlements. While hospitals, main post offices, main banks, courts, police stations are located in a town, several roads also get connected there. Railway stations too are located at some places. In topographic maps, such places are shown in pink as built up areas. Rural settlements can be identified by sub post offices, other roads, cart tracks, foot paths etc.

Physical features are mostly utilized in delimitation of the administrative borders. It becomes clear when topographic maps are observed that the administrative borders have been set along mountain ranges and rivers.
An idea about the social identity in the human community can be obtained when interpreting maps. Presence of different types of religious centres within a region itself, diversity of religions as well as type of communities can be identified.

Activity

With the teacher's advice, present the human and physical landscape of your own region or where your school is located using conventional signs, colors and symbols. Prepare a key to the conventional signs. Any land area can be selected according to your preference.

Do the following exercises using the 1: 50 000 topographic maps supplied to you on pages 139-143 in the text book itself.

Exercise -01

1. Write the relief features of the mapped area represented by the lines A-B, C-D, E-F selecting them from the brackets.
   - i. A-B (Convex slope, concave slope, gentle slope)
   - ii. C-D (spur, valley, gap)
   - iii. E-F (plain, undulated land, conical hill)
2. Identify and name the features represented by the numbers 01 -10
3. Mark whether following statements are correct or incorrect by writing "R" If right and "W" if wrong.
   - i. The paddy cultivation of the region is conducted utilizing irrigation.
   - ii. A broad gauge double railway line distributed in the North Western quarter of the mapped area.
   - iii. The length of the B 294 main road is roughly 9 km. (Reference to the Km posts).
   - iv. The elevation of the ridge located at the centre of the mapped area is above 400m.
   - v. The Southwestern quarter of the mapped area is covered with scrub lands and forests.
4. Name five public buildings, types of roads and types cultivation found in the square marked on the map.
5. In which climatic zone is the mapped area located? Give reasons for this identification.
6. What are the factors that should be considered when a short cut road is constructed from Siyambalawe to Ulpothagama.
7. Draw the cross section of X-Y.

Exercise -02.

1. Identify and name the coastal features shown by 1-5 in the map.

2. Write the numbers which represent the following drainage patterns selecting from the map. (5,6,7,8 are used).

- Meander
- Cut off Channel.
- Marshy Land.
- River Mouth.

3. Write whether following statements are correct or incorrect by writing " R " if right and " W " if wrong.

    i. Coconut is the main crop grown in the mapped area.

    ii. Settlements are mainly distributed along the coastal region of the mapped area.

    iii. Total land area of the mapped region is seen flat in nature.

    iv. A District Boundary runs in the north western quarter of the mapped area.

    v. The distance of the road B 465 that spreads northward from the place where The Divisional Secretariat is located up to the first bridge is 5 Km.

4. i. Name four main crops found in the mapped area.

    ii. Explain the relationship between the crop cultivation and the relief.

5. State the area of the mapped region in square kilometers.

6. Name the physical and cultural features found in the square marked on the map.

7. State the latitudinal location of the place. 

8. State three factors that can be utilized to develop the tourist industry in coastal region.

Exercise -03.

1. According to the scale of the map how many centimeters are used to show the distance of 1 Km.
2. Draw the linear scale to represent that scale. (1: 50 000)
3. Select the relevant number from 1-6 given in the map and re arranges the following drainage features in order.

- River valley.
- Braided river.
- Meander.
- Main River.
- Tributary.
- Watershed.

4. Name three religious places located within 1 km^2 at the Ginigathhena Junction.
5. State whether following statements are right or wrong by writing " R" if right and "w" if wrong.

    i. The mapped area belongs to the Central hills relief zone.

    ii. The mapped area slopes towards the South east.

    iii. Paddy is the main crop cultivation in the mapped area.

    iv. B 25 road that runs close to South border runs with more conspicuous bends.

    v. The south west region of the mapped area is covered with scrub forests.

6. What is the maximum height of the southwestern region of the mapped area?
7. i. Name three physical features in the square marked on the map.

    ii. State three industries that can be carried out utilizing them.

    iii. State three factors that have contributed for the development of an urban settlement in Hathdelagama.

8. Explain how the relief and the rivers have influenced the distribution of the road network of the mapped area.
9. State two factors that you can present to determine the mapped area as a catchment area.

Exercise -04.

1. State the physical features can be found at the places marked by 1,2,3,4,5 on the map choosing from the following.
    - Water pass/ Gap.
    - Concave slope/ Convex slope.
    - Valley/ Spur.
    - Isolated hill/ Mountain range.
    - Watershed/ Catchment area.
2. State whether following statements are right or wrong by writing " W" if inwrong and "R" if right.
3. i. Total western half of the mapped area shows mountain features.

    ii. A boundary of a forest reserve can be seen in the north east quarter of the mapped region.

    iii. The maximum height of the land area located east of the main road rises above the 200 m.

    iv.The distance of the road from the north border to the first bridge is 3 km.

    v. A provincial boundary can be seen close to the northern border.
4. Name the features shown by C, D, E, F, on the map choosing from the brackets in alphabetical order.

    (Abandon tank, Tank, Spot height, Boundary of sanctuary, Culvert, Bridge, Foot path, Urban council boundary.)
5. State respectively what are represented by 7^0-40', 270 values on the inner border of the map.
6. i. .State the distance in Km that a traveler will have to cover when walking from southern border to Northern border along the main road.

    ii. Write five cultural features can be found either side of the road.

    iii.Name the crops cultivated either side of the road.

    iv.Name two institutions that supply the agricultural services encountered by a traveler who travels along the road.
7. Present the factors that contribute for the existence of western half of the mapped area undeveloped.

8. Write two reasons to show the relationship between relief and the land use of the mapped area.
9. Write three factors that have contributed for the distribution of settlements in the central part of the mapped area.

Exercise -05.

1. Draw the figure of direction of the metric maps.
2. Write the relevant numbers of the following landforms choosing from the map
   - Conical hill
   - Rock outcrop
   - Meander.
   - Steep slope.
   - Longitudinal valley.
   - Braided river.
   - Valley.
   - Spur.
3. What is the elevation from the sea level the dam of the Rantambe reservoir is located?
4. What is the width of the river Mahaveli at the pace marked "A".
5. i. The highest place of the mapped region is located close to the southern border. State the height of it in meters.

   ii. Name the direction where the lowest region of the mapped area is located.
6. i. What is indicated by+ located close to the western border of the mapped area.

   ii. Accordingly, state the latitudinal location of that place.
7. i. Name respectively the two valleys through which Uma Oya and River Ma haveli flow in the mapped area.

   ii. Write two factors that have contributed to form such a drainage pattern.
8. What is the physical feature utilized in determining the provincial boundary.
9. Name three industries can be opened in the mapped area and present reasons for it.

10. What is the common agricultural land use in the southwestern quarter of the mapped area?

11. Draw the cross section of X-Y line.

Map for the exercise -01

The following is an extract from a 1:50 000 topographic map of Sri Lanka. Do the exercises given based on it.



1:50,000

Map for the exercise -02

The following is an extract from a 1:50 000 topographic map of Sri Lanka. Do the exercises given based on it.



1:50,000

Map for the exercise -03

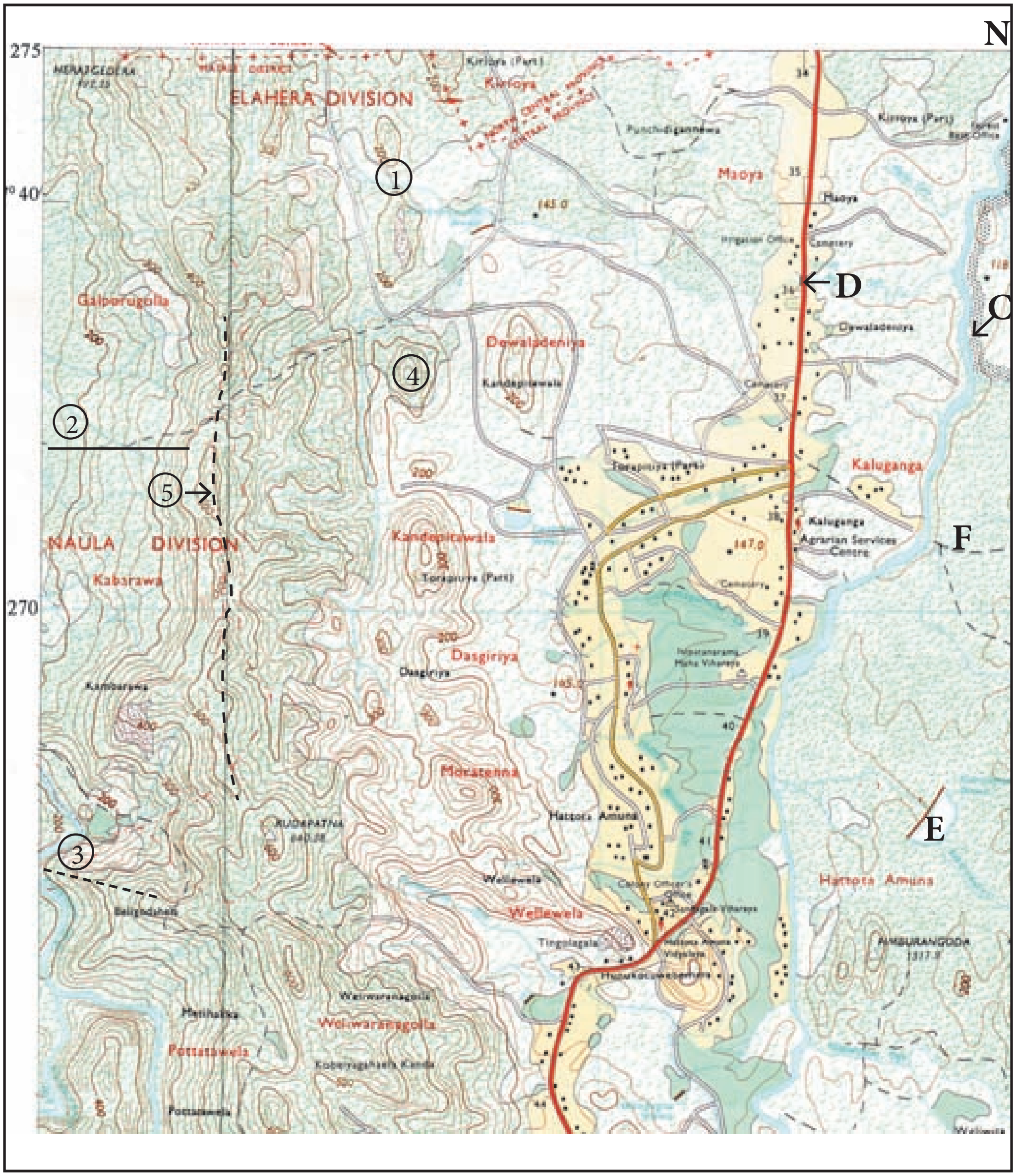
The following is an extract from a 1:50 000 topographic map of Sri Lanka. Do the exercises given based on it.



1:50,000

Map for the exercise -04

The following is an extract from a 1:50 000 topographic map of Sri Lanka. Do the exercises given based on it.



1:50,000

Map for the exercise -05

The following is an extract from a 1:50 000 topographic map of Sri Lanka. Do the exercises given based on it.



1:50,000

Bibliography and Sources

- 10 - 11 සමාජ අධ්‍යයනය විෂයය සඳහා සිතියම් අධ්‍යයනය (1999), අධ්‍යාපන ප්‍රකාශන දෙපාර්තමේන්තුව.
- මෙට්‍රික් සිතියම්, ශ්‍රී ලංකා මිනුම් දෙපාර්තමේන්තුව.

Glossary

- Topographical map - භූ ලක්ෂණ සිතියම - இடவிளக்கப் படம்
- Physical features - භෞතික ලක්ෂණ - பௌதிக அம்சங்கள்
- Cultural features - සංස්කෘතික ලක්ෂණ - பண்பாட்டு அம்சங்கள்
- Relief features - භූ විෂමතා ලක්ෂණ - தரைத்தோற்ற அம்சங்கள்
- Contour lines - සමෝච්ච රේඛා - சமயுயரக் கோடுகள்
- Plain - තැනිතලා - சமவெளி
- Spot height - ස්ථානීය උස - இட உயரம்
- Undulating lands - රැළි බිම් - தொடரலை நிலம்
- Highlands - උස් බිම් - உயர் நிலம்
- Valley - නිම්නය - பள்ளத்தாக்கு
- Spur - තෙරුව - சுவடு
- Mountain range - කඳුවැටිය - மலைத்தொடர்
- Ridge - හෙල්වැටිය - பாறைத் தொடர்
- Isolated hill - හුදකලා කන්ද - தனிக்குன்று
- Conical hill - කොත් කන්ද - கூம்புக் குன்று
- Escarpment - මොහොර බෑවුම - ஓங்கல் சாய்வு
- Gentle slope - මඳ බෑවුම - மென் சாய்வு
- Convex slope - උත්තල බෑවුම - குவிவுச் சாய்வு
- Concave slope - අවතල බෑවුම - குழிவுச் சாய்வு

- Gap - කපොල්ල - கணவாய்
- Cross section - හරස්කඩ - பக்கப்பார்வை
- River system - ගංගා මණ්ඩලය - ஆற்றுத் தொகுதி
- Transverse valley - තීර්යක් නිම්නය - குறுக்குப் பள்ளத்தாக்கு
- Longitudinal valley - ආයත නිම්නය - நெடுக்குப் பள்ளத்தாக்கு
- Water divide - දිය බෙත්ම - நீர்ப்பிரி நிலம்
- Meander - ගංදඟරය - மியாந்தர் வளைவு
- Marshy land - වගුරු බිම් - சதுப்பு நிலம்
- Braided river - හැඩපලු ගංගාව - பின்னிய ஆறு
- Distributories - අපශාඛා - கிளை ஆறு
- Radial drainage pattern - අරීය ජලවහන රටාව - ஆரை வடிகால் பாங்கு
- Dendritic drainage pattern - ශාඛීය ජලවහන රටාව - மர நிகர் வடிகால் பாங்கு
- Trellised drainage pattern- ජාලාකාර ජලවහන රටාව - அளியடைப்பு வடிகால் பாங்கு
- Lagoon - කලපුව - கடனீரேரி
- Bay - බොක්ක - குடா
- Point / Cape - තුඩුව - முனை
- Sand bar - වැලිපරය - மணற்றடை
- Island - දූපත් - தீவு
- Coast - වෙරළ ඉම - கரையோரம்
- Administrative boundary - පරිපාලන මායිම් - நிர்வாக எல்லை

10 Using Graphs to Represent Data

Like in studying any other subject, in studying geography too statistical tables are used a great deal to collect necessary data and information. The graph can be considered as a medium that is used to understand the information present in statistical tables easily and quickly.

The basic objective of this chapter is to make one understand about the simple line graph, multiple bar graph, and the simple divided circles which are used to represent data.

When a statistical table is presented in a graph, it is important to have a good understanding about the nature of the data and the most suitable type of graph necessary to represent it.

Simple Line Graph

Presentation of data in a statistical table by lines is done in a line graph. This line graph is much used to represent the variables that change with time. The temperature, atmospheric pressure, the growth of the population and the state revenue are some examples of the variables that are represented by simple line graphs. Simple line graphs are mostly used because of the ease in drawing them and also because the trends could be instantly understood.

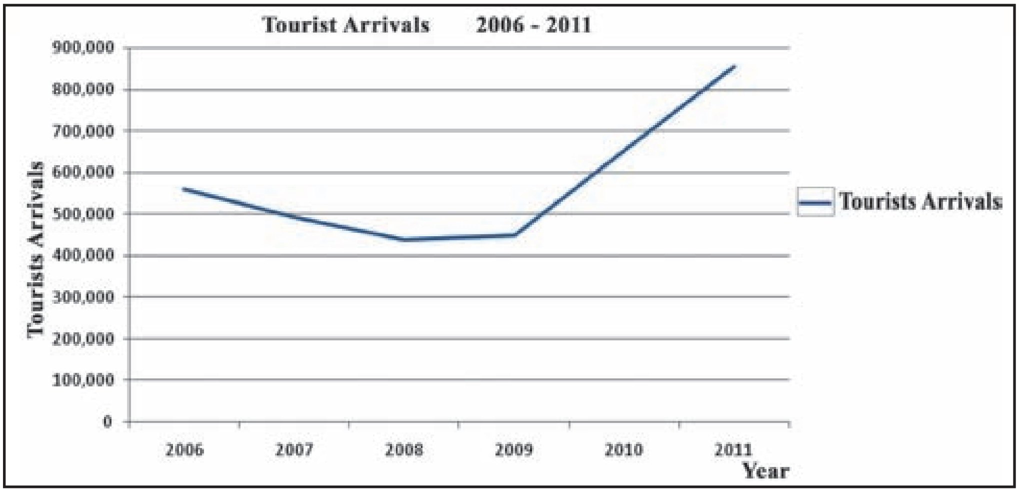
The factors that should be considered when graph is drawn

- Selection of a suitable scale according to the statistical table given.
- Marking time on the horizontal axis and the relevant variables on the vertical axis.
- Setting the vertical scale taking the minimum of the relevant statistical table as zero and the round number next to the highest value of the statistics as the maximum.
- Marking "0" at the foot of the vertical axis and "100" at the top when percentage values are represented.
- Writing a suitable heading according to the statistics in the table.
- Using a suitable color for the line that a single variable is represented.

The graph drawn based on the data of the table 10.1 is shown below.

Table 10 .1 Tourists Arrivals 2006- 2011

2006	2007	2008	2009	2010	2011
559,603	494,008	438,475	447,890	654,476	855,975



Graph 10.1 - Simple Line Graph

Source - *Annual Report, Central Bank of Sri Lanka, 2012.*

The basic features of a graph

- Title.
- Scale (Vertical & Horizontal)
- Key
- Frame.
- Source.

Activities

1. Draw a simple line graph using a suitable statistical table.
2. State two factors reflected by the graph.

Multiple Bar Graphs

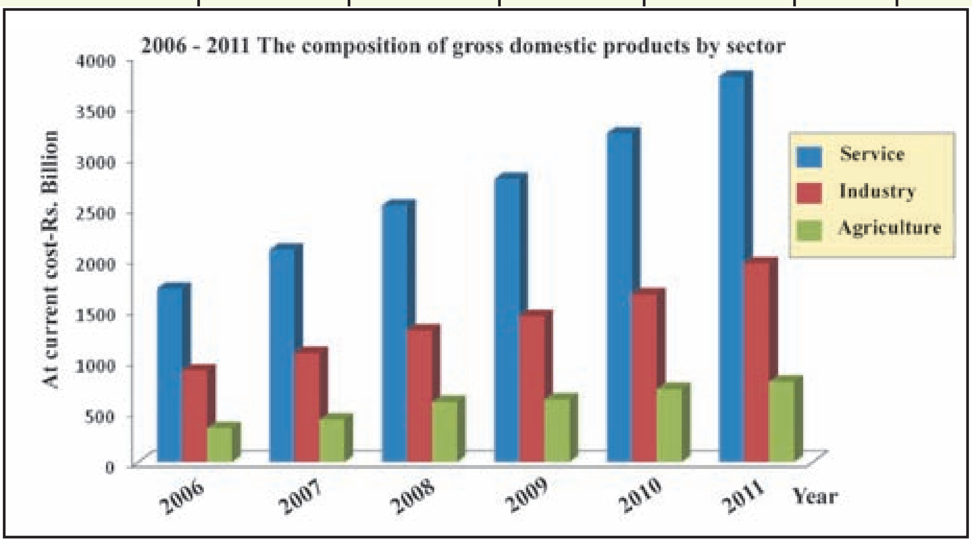
Presentation of a statistical table using bars is done by a bar graph. These bars can be drawn either horizontally or vertically. Multiple bar graphs are used when the data of several variables are presented. A multiple bar graph is more suitable for the representation of the data like the annual production of several goods and number of different vehicles registered over several years etc. Ability to identify the numerical value of a variable easily, ability to compare several variables of a year and the ability to study the periodical trends of those variables comparatively are the benefits of this method of graph.

When multiple bar graphs are drawn, the following factors should be considered.

- Determining the vertical scale according to the maximum and minimum values of the statistical table.
- Marking the time on horizontal axis and the amount on vertical axis.
- Setting starting point of the vertical axis as zero (0).
- Drawing the bars of relevant years joining to each other with equal width.
- Showing by separating the group of bars of a year from the bars of other year.
- Showing the bars of the same variable relating to a particular year by the same color or design.
- Showing used colors or designs by a key.

Table 10.2. - The composition of gross domestic products by sectors.(At current cost-Rs. Billion)

	2006	2007	2008	2009	2010	2011
Service	1705	2091	2525	2787	3237	3795
Industry	900	1071	1295	1435	1649	1957
Agriculture	333	418	590	614	718	791



Graph 10.2 - Multiple Bar Graph.

Source - *Socio Economic Data of Sri Lanka 2012*

According to the graph, the which variable depicts the heighest growth during the period of 2006 - 2011

Activities

1. Name the variables represented in the graph.
2. What is the development of that variable during 2006- 2011 in rupees billions.

Assignment

- Prepare a multiple bar graph based on a statistical table found in the Central Bank Annual Report or on any other statistical table.
- State the temporal variations of the each of the variable.

Divided Circles

The circle graph that is used to represent the composition of the variables included in a certain statistical table is known as a divided circle graph. In this graph, total value of all the variables is considered 360◦ and according to the value of each variable, 360◦ is divided into sub parts. The divided circle graph is most suitable to represent data like composition of ethnic groups of a country, religious composition, and export and import composition.

The composition of variables as well as their proportion could be understood comparatively in a divided circle graph.

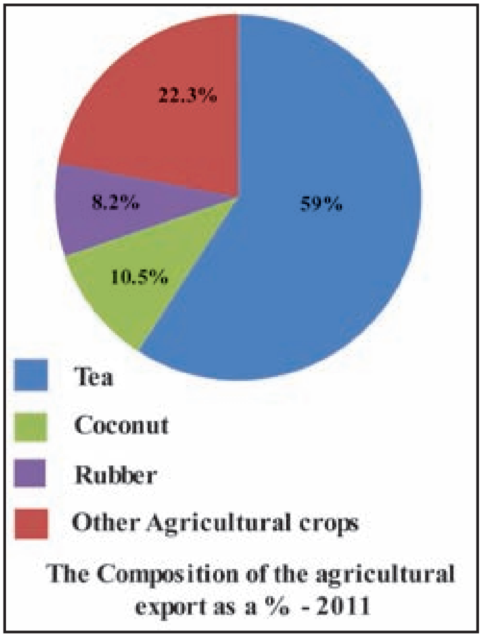
When drawing a divided circle graph the following steps should be considered.

- Drawing a circle using a suitable radius for the graph.
- Deciding the value of angle of the each variable considering the value of the total variables of 360◦.
- Finding the value of each variable according to the percentage value when composition is given in percentage considering 360◦ value of the circle as 100.
- Marking the angular values clockwise according to the size from the base line that is drawn from the centre of the circle until it meets the circumference towards North.
- Placing at the end, If there is a variable marked as "others".
- Completing the drawing of the graph by setting the key with the colors used, to show the composition, scale, heading and the source of data.

Table 10.3. - The Composition of the agricultural export- 2011 (Rs. Millions)

	2011	Percentage %	Value according to 360°
Tea	164,869	59%	212^0
Coconut	29,394	10.5%	38^0
Rubber	22,811	8.2%	30^0
Other Agricultural crops	62,392	22.3%	80^0
Agricultural export	279,466	100%	360^0

Source- *Central Bank Annual Report 2012.*



Graph 10.3 - Sample Divided Circle graph

Source : *Socio Economic Data of Sri Lanka - 2012*

Activities

1. Name the composition of the variables represented in the graph.
2. What is the variable that claims the highest amount of exports?
3. State two uses of this graph.

Assignment

Represent the data taken either from the Annual Central Bank Report or from any other suitable statistical table by using a divided circle graph.

Bibliography and Sources

- ශ්‍රී ලංකා මහ බැංකු වාර්තාව (2012).
- ශ්‍රී ලංකා සමාජ ආර්ථික දත්ත -(2012), මහ බැංකු වාර්තාව.

Glossary

- Representation of data - දත්ත නිරූපණය - தரவுகளை விளக்குதல்
- Graphs - ප්‍රස්තාර - வரைபுகள்
- Simple Line Graphs - සරල රේඛා ප්‍රස්තාරය - சாதாரண கோட்டு வரைபுகள்
- Multiple Line Graphs - බහු තීරු ප්‍රස්තාරය - பல் பார் வரைபுகள்
- Simple Divided Circle Graphs - සරල බෙදුම් වෘත්ත ප්‍රස්තාරය - சாதாரண பிரிக்கப்பட்ட வட்ட வரைபுகள்
- Variables - විචල්‍යය - மாறிகள்
- Horizontal axis - තිරස් අක්ෂය - கிடையச்சு
- Vertical axis - සිරස් අක්ෂය - செங்குத்தச்சு
- Minimum - අවමය - இழிவுப் பெறுமானம்
- Zero - ශුන්‍යය - பூச்சியப் பெறுமானம்
- Maximum - උපරිමය - உச்சிப் பெறுமானம்
- Percentage - ප්‍රතිශතය - சதவீதம்
- Gross domestic product - දළ දේශීය නිෂ්පාදිතය - மொத்த உள்நாட்டு உற்பத்தி

- Ethnic composition - වාර්ගික සංයුතිය - இனரீதியான உள்ளடக்கம்
- Religious composition - ආගමික සංයුතිය - சமயரீதியான உள்ளடக்கம்
- Export composition - අපනයන සංයුතිය - ஏற்றுமதி உள்ளடக்கம்
- Import composition - ආනයන සංයුතිය - இறக்குமதி உள்ளடக்கம்